UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

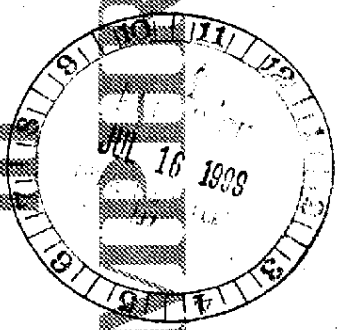
THE NORTHWEST LABORERS-EMPLOYERS HEALTH & SECURITY TRUST FUND, and its TRUSTEES; et al

Plaintiffs,

v.

PHILIP MORRIS, INC.; et al,
Defendants.

NO. C97-849WD



Shook, Hardy & Bacon, L.L.P.
Miami Center, Suite 2400
201 South Biscayne Boulevard
Miami, Florida 33131-4332
June 29, 1999
9:05 p.m.

DEPOSITION
OF
DR. CHRISTIAN D. WUNSCH

Taken before Teresita Miranda, Registered Professional Reporter and Notary Public, in and for the State of Florida At Large pursuant to Notice of Taking Deposition.

COPY

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EXHIBITS INTRODUCED

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THEREUPON:

DR. CHRISTIAN D. WUNSCH

was called as a witness, and after having been first duly sworn, testified as follows:

DIRECT Examination

BY MR. WITHEY:

Q. Could you state your name and give your business address for the record, please.

A. My name is Christian D. Wunsch, and my business address is Jackson Memorial Hospital 1611 Northwest 12th Avenue, Miami, Florida 33136.

Q. How are you employed there?

A. I'm employed by the University of Miami School of Medicine.

Q. And what department?

A. In the Department of Pathology.

Q. Dr. Wunsch, my name is Mike Withey. I represent the Plaintiffs in this case. I have some questions for you this morning. If you don't understand any question, feel it is too vague to answer, would you ask me to rephrase it?

A. I will.

Q. I assume if you answer it it is because you can understand it and it is not too vague, fair enough?

A. Fair enough.

Q. You understand you are under oath and the court

reporter is taking down everything you say?

A. I understand.

Q. You understand this deposition might be used at the time of trial?

A. I understand.

Q. And therefore it is important to be as truthful and accurate as you can?

A. I understand.

Q. All right. Dr. Wunsch, I have marked as Exhibit 1 your report in this litigation, and I wondered if you could verify that is in fact your expert report that was submitted pursuant to the federal rules?

A. Yes, it is.

Q. All right. And attached to that report is your curriculum vitae. Is that relatively current, sir?

A. It is.

Q. All right. Could you describe what you have read related to this case that's distinct from any other tobacco litigation that you've been involved in? For instance, have you read the complaint in this case?

A. I have not.

Q. Have you read any of the experts' reports of the Plaintiffs in this case?

A. I have not.

Q. Have you read any of the experts' reports of any

of the other Defense experts?

A. I have read one.

Q. Which one?

A. Dr. Mundt's expert disclosure.

Q. Okay. And did you take notes on that?

A. No, I did not.

Q. When did you read it?

A. A few days ago.

Q. What was your purpose in reading it?

A. As you may note from my expert disclosure that I have a special portion called Etiology of Human Diseases and Cancers, and that particular section is an area that is covered in large measure, and probably and definitely by more experts and certainly by more professional viewpoints of Dr. Mundt, and I expressed an interest and counsel gave me a copy.

Q. All right. And I take it you would then recognize that Dr. Mundt is an epidemiologist and you are not?

A. That's correct.

Q. And that he -- well, after reviewing his report did you have any reason to change any of your report?

A. None whatsoever.

Q. Do you have any reason to add to the opinions that you expressed in your report?

A. I felt much more comfortable expressing opinions

that I had already expressed in this case and in my expert disclosure and would have otherwise had expressed today.

Q. You feel more comfortable having read Doctor --

A. Yes.

Q. You are going to have to wait until I finish and I will try to wait, or else this court reporter is going to strangle both of us.

You felt more comfortable in expressing the opinions you already formulated after reading Dr. Mundt's report, correct?

A. Correct.

Q. Have you read anything else that is related specifically to this case, Northwest Laborers versus Philip Morris?

A. I have not.

Q. Have you identified in your report all the documents or medical literature that you relied upon in formulating this opinion?

A. I have not.

Q. And that's because you based your report, excuse me, your opinions on your background and training?

A. Correct.

Q. And it would be impossible to list every medical article and book you've ever read?

A. Absolutely.

Q. Other than your general background and training, however, you have listed the documents that you have in fact relied upon in formulating your opinion; is that correct?

A. Sum up, yes, I mean, a representative sampling.

Q. Well, how did you go about the selection process in identifying your reliance material on the last two pages of this report?

A. Approximately two years ago I carried out some discussions with counsels involved in, not this particular suit, but in a related suit. And as a consequence of those discussions, I was asked if I would be expressing the same opinions I expressed at that time as an expert witness, and I said that I would. And at that point I was told that it was necessary to provide for disclosure documents that which would be a representative sampling. I have several references on my own that were fairly easy to find which I had suggested to counsel. Counsels had some others that they asked me whether I had read particular articles. Some of them I had; some I hadn't.

And as a consequence of all of those discussions, this ended up being the final list that was selected as a representative document.

Q. Who typed this list up?

A. I have no idea.

Q. Was it someone at your office --

A. It wasn't --

Q. You are going to have to wait until I finish my question.

A. Sorry.

Q. Was it someone at Shook, Hardy and Bacon?

A. Either someone from Shook, Hardy and Bacon or somebody that they had employed, I suppose.

Q. Well, have you had conversations with lawyers representing the tobacco industry in relationship to your testimony in this case?

A. Would you ask that question one more time?

Q. Have you had conversations with lawyers that represent the tobacco industry in connection with your work in this case?

A. Yes.

Q. With whom have you had such conversations?

A. With probably four or five separate attorneys of Shook, Hardy and I think one legal consultant of theirs.

Q. Do you recall their names?

A. I recall several of their names.

Q. Why don't you give me the names that you recall.

A. Okay. Clyde Curtis, Keith, I always have problems with Keith's last name.

MR. REILLY: Mormon.

THE WITNESS: Yes.

Susan Harshman. Two counselors who are here today, Ken Reilly and Christopher Johnson. Those are the ones that I can name at this point.

Q. (By Mr. Withey) And do you recall the name of the legal consultant or the consultant?

A. I think it was Susan Harshman. I don't think she was an employee.

Q. Do you know who typed your report up?

A. No.

Q. Was it done in your office?

A. No.

Q. Do you recall -- do you believe it was done by Shook, Hardy and Bacon?

A. Either by them or a representative of theirs.

Q. By a representative would that include Ms. Harshman?

A. Yes.

Q. Was the first draft of your report sent to you by either Shook, Hardy and Bacon or a representative of theirs?

A. Yes, it was.

Q. Now, is your C.V. attached to Exhibit 1, sir?

A. Yes.

Q. You list in your C.V. on page two publications and refereed journals, do you see that?

A. Uh-huh.

Q. You are going to have to answer audibly.
A. Yes.
Q. Do any of those deal with any of the medical issues related to smoking and health?
A. I don't think you would say that the relationship is a direct relationship. There are indirect relationships.
Q. You have not conducted, as I understand it, and/or participated in any epidemiological study on the effects of smoking on humans.
A. I have not.
Q. Have you published in any peer review literature, any article that looked at the pathology of any of the diseases that the Surgeon General has related to smoking and its relationship to smoking? Do you understand the question?
A. I think I do. No, I have not.
Q. All right. Have you published anything in the medical literature on inferring causation from epidemiological studies?
A. I don't recall.
Q. Have you published anything in the medical literature on ICD-9 coding?
A. No, I have not.
Q. Have you published anything in the medical literature on chronic obstructive pulmonary disease?

A. No, I have not.

Q. Have you published anything in the medical literature on heart disease or cardiovascular disease?

A. Not that I recall.

Q. Have you published anything in the medical literature on risk factors for human diseases and cancers?

A. No, I have not.

Q. Have you published anything in the medical literature on the misdiagnosis of human diseases and cancers?

A. No, I have not.

Q. Have you done any research either in your hospital or in any other institution on the topic of misdiagnosis of human diseases and cancers?

A. I have carried out a number of studies associated with misdiagnosis, misclassification, miscoding as a consequence of my responsibilities in the. Hospital, I have not published those studies.

Q. Are those studies in written form?

A. No, they are not.

Q. Well, is there any written evidence of the fact that you did such a study?

A. There may be some memos to that effect, but I don't have any specific recollection --

Q. Where?

A. -- of those notes.

Q. Where are those memos?

A. If they are, they are memos that I have already sent to other people, and I don't normally maintain copies of my memos.

Q. And when did you do such studies, that is, as to the misdiagnosis, miscoding, misclassification of diseases? I assume this is at the hospital you are working at now?

A. Yes, I have been a member of the medical records committee for the past twenty some years. And part of medical records' responsibility is diagnosis and coding, and there is a number of instances in which medical records depends upon information provided by our department for part of the -- part of the medical encoding. And there has been some audits that I have participated in with respect to determining diagnostic accuracy of records. Those audits I'm sure if one wanted to spend enough time digging through the thousand plus audits that are conducted on an annual basis at the hospital, one could find several of those that I have performed. And part of the audit process was the verification and the check of the diagnosis.

Q. I think the question I asked you is when you did them.

A. I've done them over the course of the last 20 years.

Q. How many?

A. Probably hundreds of records.

Q. No, I'm asking studies, not how many records have you done.

How many audits or studies did you perform on the misdiagnosis and miscoding?

A. Audits? Probably hundreds.

Q. And do you distinguish studies from audits, Doctor?

A. I don't.

Q. Okay. And of the hundreds of audits or studies that you performed on misdiagnosis, do you have in your files or in the files in the hospital a record of any of them?

A. As far as I know, I don't. I have turned all those in to the medical records office.

Q. Would the medical records office have a copy?

A. I don't have a clue.

Q. You are going to have to wait till I finish.

MR. REILLY: And give me an opportunity to object to the question.

Object to the form of the question.

Q. (By Mr. Withey) That's another reason to wait till I finish my question.

A. Great.

Q. So if you were to call down to the medical records department that you've worked for for twenty some odds years and say, I'd like to get a copy of the audit of the medical records or whatever it was you audited, they could give you a copy of it if they have it, right?

A. If they had it. If they could find it.

Q. Who would you call?

A. The person who would probably be most knowledgeable is no longer there, so the current medical records librarian might be called. I don't think that they save that kind of documentation. I would be surprised if they did.

Q. I just asked you who to call.

A. Well, I probably wouldn't call because I probably wouldn't expect anyone to be able to produce the record.

Q. All right. So as far as you know there are no records of any of the audits, reports or studies you've done of the miscoding or misdiagnosis at your hospital?

A. As far as I know.

Q. And you certainly haven't published the results of those studies in any paper that you've written, correct?

A. No.

Q. Now, you also list other works, publications and abstracts and other reviews and publications in your C.V.; is that correct?

A. Yes.

Q. And I asked you some questions about your published studies, and I guess I should ask you the same questions as to other works, publications, abstracts and other reviews whether any of them deal with the topics specifically of smoking and human health.

A. As far as I know there are none that deal directly with the topic.

Q. Do any of them deal with risk factors for human diseases and cancers?

A. Not to my knowledge.

Q. Do any of them deal with misdiagnosis of human diseases and cancers including miscoding?

A. No.

Q. Do any of them deal with C.O.P.D., cardiovascular disease?

A. No.

Q. Do any of them deal with the topic of proportioning of etiology of human diseases and cancers?

A. No.

Q. Have you ever testified in a tobacco case other than by deposition?

A. No.

Q. Were you scheduled to appear in the Minnesota trial?

MR. REILLY: Well, let me interpose my objection. That calls for counsel communication and is unrelated to this litigation. I'd have to instruct him not to answer that if he was subpoenaed. If he has some knowledge other than through the mental process of some lawyer, then I will let him answer it.

Q. (By Mr. Withey) Were you designated as an expert witness?

A. I was deposed as an expert witness, yes.

Q. And they designated you as an expert witness?

A. Yes.

Q. They told the Plaintiffs that you were going to be an expert witness in that case?

A. That's correct.

Q. And did you understand that there was a trial of the Minnesota case?

A. Yes.

Q. And did you participate in that trial?

A. No.

Q. Do you know why you didn't participate in the trial?

A. No.

Q. Did anybody tell you why you didn't participate in the trial?

MR. REILLY: Same objection, same instruction.

THE WITNESS: No.

Q. (By Mr. Withey) Your resume says you are a member of the Chemical Manufacturer Association.

A. No, it doesn't say that.

Q. Did I misname it?

Excuse me, American Chemical Society, I beg your pardon.

A. An enormous difference between those organizations.

Q. Of course. How long were you -- for 30 years you are a member of the American Chemical Society?

A. Yeah.

Q. And back in 1963 were you familiar with the warning labels on many of the chemicals that were commonly used in the work place?

A. Yes.

Q. And did you think that was a good idea?

A. What was a good idea?

Q. Having warnings on chemicals.

A. There has always been warnings on chemicals.

Q. Do you think it was a good idea?

A. It wasn't 1963 that they invented the concept.

Q. I didn't mean to imply that. Thank you for that clarification. It is going back to the '30's, '40's, '50's, '60's they had warnings on various chemicals that were used

commonly in the work place.

A. Correct.

Q. Do you think that was a good idea?

A. Yes.

Q. Why?

A. There is always a possible hazard for someone who is unfamiliar with what may be contained in a bottle, and some sort of warning indicating that the material is flammable or the material may be toxic or whatever is a good idea.

Q. So I take it then that the purpose, one of the purposes of the warning on chemicals is to inform the user with the potential hazard, correct?

MR. REILLY: Object to the form of the question.

Q. (By Mr. Withey) Correct?

A. Yes.

Q. Many of the users of chemicals already had knowledge about the hazards of those chemicals, fair enough?

MR. REILLY: Object to the form of the question.

THE WITNESS: I would expect most of them did, yes.

Q. (By Mr. Withey) Did you as part of the American Chemical Society ever write any reports or do any research about the effectiveness of chemical warnings?

A. No.

Q. What work did you do for the American Chemical Society?

A. The American Chemical Society is a professional organizations sort of like the National Bar Association, I would guess. It is a professional organization representing the professional interest of chemists. I never worked for them.

Q. No, but --

A. Neither do 99.9 percent of the members.

Q. Right. It says society memberships and offices. Were you an officer of the American Chemical Society?

A. I don't believe I was ever an officer. I may have been a local section secretary or something like that.

Q. Okay.

You consider yourself then a chemist?

A. Yes.

Q. Do you still consider yourself a chemist?

A. I do.

Q. Did you attend society meetings from time to time?

A. Yes.

Q. National conferences?

A. Yes.

Q. Were you a fairly active member in that sense of going to most of the conferences?

A. Yes, at one time, yes.

Q. And did you present papers at conferences?

A. I did.

Q. And did any of the conferences that you went to was there ever any papers presented to the best of your recollection on proper warning labels for chemicals?

A. I have no recollection of such papers.

Q. Now, one of the general textbooks that you referenced in your bibliography is the Harrison's Principles of Internal Medicine; isn't it?

A. Yes.

Q. Do you consider that to be an authoritative source about disease and etiology?

A. I consider it to be a reference source of information.

Q. Commonly used in medical schools?

A. Yes, it is.

Q. Have you used it yourself?

A. Yes, I have.

Q. How have you used it?

A. I've used it as a reference source.

Q. Something you pull down from your shelf and look at if you need to refer to some particular issue?

A. Yes.

Q. And when you pulled it down and looked at it from time to time did you consider the information contained

there reliable?

A. I regard it as reliable as a source of information as most reference quality textbooks, yes.

Q. And I would ask you the same question as to the next general reference textbook Cancer: Principles and Practices of Oncology edited by DeVita, would you give me the same answers as you gave for Harrison's?

A. I would give the same answers.

Q. There are some specific chapters in DeVita that deals with issues related to cancer, the causation epidemiology, correct?

A. There are.

Q. Have you read those?

A. I have.

Q. Do you consider that a textbook that presents reliable information?

A. I regard it as a reputable high quality.

Q. It is widely used in medical school, correct?

A. It is widely used in physician training, particularly among hematologists, oncologists.

Q. Have you read chapter three of the 1989 report of the U.S. Surgeon General in Smoking and Health?

A. I don't recall in that context.

Q. From your review of Harrison's work and the DeVita work and your general background and training, are you

familiar with the concept of relative risks?

A. I am.

Q. If a disease is not associated with a given exposure, what is the relative risk in relationship to that exposure?

A. Somewhere between zero and infinity.

Q. Well, wouldn't it be more accurate to say that if a disease is not associated with exposure that the relative risk and relationship to that exposure is one?

MR. REILLY: Object to form.

THE WITNESS: No, it would not be.

Q. (By Mr. Withey) Do you understand what the word positively associated with exposure means?

A. Yes.

Q. What do you understand that term to mean?

A. That means that the relative risk is greater than one.

Q. Have you ever used the term or understand the term of risk factor?

A. Yes.

Q. How would you define risk factor, sir?

A. A risk factor is some factor which has been identified in a study, statistical study, of related events, related to whatever the item is under discussion.

Q. Are there gradations of risk factors in your

judgment?

A. The statistics produce smaller or larger numbers, and these are normally regarded as being smaller and larger.

Q. What set of criteria do you use to determine whether a particular exposure, condition or event is a risk factor?

A. The statistical criteria is that the risk factor in the statistical study under question has certain confidence interval that would indicate the number would not have occurred by chance or a risk interval that the number is significantly different than one if we looked at relative risk.

Q. Do you use any criteria in determining whether a particular exposure or condition is a risk factor that includes an examination of the strength of association, i.e., how much above one is the relative risk?

MR. REILLY: Object to the form.

THE WITNESS: Do I have a working definition? Again, first of all, it has to be -- it has to first of all the number itself it has to be interpreted within the context of the competence interval. If the confidence interval, as an example, is between .4 and 4 and the relative risk is 3, then I regard the relative risk as being meaningless. On the other hand, if the confidence interval is between .8 and 1.3, then the risk

factor or the risk ratio is 3, then I would say that it is statistically significant.

Q. (By Mr. Withey) I understand. I'm asking a little bit of different question. Do you understand what I mean by the term strength of association?

A. I think I just answered that.

Q. Assuming --

MR. REILLY: Let me interpose an objection to form.

Q. (By Mr. Withey) Assuming the risk factor excludes unity in terms of its confidence, in other words, assume it is not by chance but significancy, would it be true that to determine whether something is or is not a risk factor for a given disease you would want to know how strong is the association between the exposure and the disease?

A. If I go back to the first part of your question, I have never in my entire life seen a study published that had a risk factor of exactly one. I have never seen a 1.000 risk factor. Okay. We never end up with a risk factor of one. We always end up with a risk factor maybe around one, maybe larger than one or maybe smaller than one.

In those particular circumstances the first thing you have to do to qualify the meaning of statistic is to express it with respect to its confidence interval. That is to say, whether or not there is enough statistical data to

warrant an interpretation beyond the particular range. Without that information, any particular number is meaningless.

Q. My question asked, do you assume that the positive association is statistically significant?

A. All right.

Q. It is above one, and it is statistically significant. Do you draw any distinctions between those risk factors that have relative risks of for instance 20 and those that have relative risks of 1.5?

A. Yes.

Q. What distinction do you draw?

A. The distinction is that there is a closer statistical relationship in the one that has the 20 than there is with the one that has a 1.5.

Q. Do you use any other -- well, do you examine in determining whether something is a risk factor the numerical value of the relative risk i.e., whether it is 20 or 1.5, is that something you examine in determining whether something is or is not a risk factor?

A. That's a consideration.

Q. Why?

A. To a large extent it depends upon how the numbers are produced. It depends on how the study is conducted and it depends specifically on what the risk factor is. Let's

assume as an example that I could do a study, just an assumption, of Coca Cola consumption versus bone cancer, and I discover that there was a risk factor of 3 or 8 or 20, okay, would I necessarily infer that there is some sort of strong relationship that exists between Coca Cola and bone cancer? The answer of that question is, no, I wouldn't. It would appear on the surface though that there was a major risk factor involved. In fact, obviously Coca Cola drinking and something else are related, and it is the sort of thing you would regard as being a confounder if you were able to determine what the relationship was between something that you could later demonstrate was a true causative agent.

Q. By your definition is smoking a risk factor for any disease?

A. Yes.

Q. Which disease?

A. It is a risk factor. It has been identified as a statistical risk factor in a large number of studies associated with lung cancer in specific lung cancers. It has been a factor that has been identified as a risk factor with laryngeal cancer, with esophageal cancer, with colon cancer, with pancreatic cancer, and it has been identified as a risk factor associated with certain forms of C.O.P.D. I'm reciting in effect literature studies that have identified smoking as a risk factor.

Q. Any other diseases that smoking is a risk factor for, sir?

A. There probably are.

Q. Coronary heart disease?

A. Oh, it has been identified as a risk factor in some coronary heart disease studies.

Q. Cerebral vascular lesions?

A. I'm certain there are some studies that have identified as such.

Q. Kidney cancer?

A. Possibly.

Q. So I guess as I understand your testimony, and correct me if I'm wrong, in determining whether or not something is a risk factor for disease you would want to look to how well the studies were conducted that showed the statistical association, correct?

A. Yes.

Q. And whether the studies are generally consistent with one another over a number of different populations?

A. That's a different issue.

I've never regarded that as a very strong way of faring out the truth.

Q. Is it a factor that you would look at in determining whether something is or is not a risk factor?

A. Absolutely.

Q. Would you want to look to see if there is a temporal relationship, that is, the exposure or event preceding the onset of disease?

A. Yes.

Q. Now, are you familiar with the set of criteria that have been developed by epidemiological scientists as to how to infer causation from a set of epidemiological studies?

MR. REILLY: Object to the form of the question.

THE WITNESS: I believe I know what you are referring to.

Q. (By Mr. Wither) What am I referring to?

MR. REILLY: Object to the form of the question.

THE WITNESS: You are referring to what some epidemiologists -- I don't think there is any school of epidemiology that necessarily embraces a specific set of statistical criteria, epidemiological criteria, that infer causation, but there are certain epidemiologists that feel that there are certain sets of criteria that once met infer causation.

Q. (By Mr. Wither) What are those criteria if you know?

A. I can name some of them. The criteria that there is a risk factor which presumes to have been isolated, and those instances in which that particular factor can be

quantitated with respect to exposure, There should be some relationship between the exposure and the risk ratios that are involved, that there should be at least some underlying theoretical mechanism by which there is a relationship between the risk factor and the event that is being studied that produces the risk ratio. I think those are probably the three strongest elements. I think there is another couple, but I don't recall what they are.

Q. Can you think of anywhere in the literature that's described at, that that set of criteria is set forth in writing?

MR. REILLY: Object to the form of the question.

THE WITNESS: Have I read before criteria written down in that fashion? Yes, I have.

Q. (By Mr. Wither) Can you state anywhere in the literature --

A. I can't cite you the literature reference.

MR. REILLY: You need to let him finish the question, so I can make an objection.

Q. (By Mr. Wither) Is it found in Harrison's?

A. I would be surprised if it were.

Q. Is it found in DeVita?

A. I don't believe it is.

Q. Is it found in any of the reliance materials that you've set forth in Exhibit 1 under your bibliography for

Dr. Wunsch?

Feel free to look at it if you need to.

A. I don't believe so.

Q. Is that a criteria that you use?

A. What?

Q. The one that you just gave.

A. I don't use that as a criteria. I don't regard that as an acceptable criteria.

Q. What criteria do you use in determining whether a given exposure causes a given disease outcome in human beings?

MR. REILLY: Let me pose an objection.

THE WITNESS: Did you finish?

MR. REILLY: I didn't have time to make an objection. I object to the form of the question.

THE WITNESS: Epidemiological data in and of itself is absolutely totally incapable of demonstrating causation.

Q. (By Mr. Wither) I asked you what set of criteria, if any, do you use in determining whether a specific exposure causes specific diseases in human population.

MR. REILLY: Same objection.

Q. (By Mr. Wither) If you use any.

A. A specific exposure?

Q. Yes, such as smoking or exposure to formaldehyde

or exposure to asbestos, for instance, and any disease outcomes such as lung cancer, for instance.

MR. REILLY: I object to the form of the question.

THE WITNESS: Exposure to Mycobacterium tuberculosis definitely is a factor that results in the causation of tuberculosis. So if we are talking about exposure, are there certain things? Yes. And there are criteria for those particular kinds of disease processes. The criteria is a basic understanding of the disease from a basic science viewpoint to where we understand causation in the ordinary sense of causation, that, is, there is an intimate direct relationship that's between some particular agent and the particular biological processes that are affected to produce whatever our endpoint is, disease, symptomatology, some manifestation, whatever it is we are studying.

Q. (By Mr. Mr. Withey) So that's your criteria that you just explained?

A. Yes.

Q. And is that criteria for disease causation set forth in any publication that you can name today?

A. Yes.

Q. Which one?

A. I'm absolutely positive it is set forth in several.

Q. Name one.

A. Can I name you one? No, I can't.

Q. Are there any of the publications that sets forth that definition of causation and the criteria that you just gave in any of the publications that you've referenced in your bibliography, Dr. Wunsch?

A. I regard it as being such a fundamental understanding of the modern philosophy of science that it is something that one wouldn't even bother to write down.

Q. I take it the answer is no, that definition criteria are not set forth in writing in any of the bibliography materials that you have cited; is that correct?

A. That is correct as far as I know.

Q. Let's see if there is in your material some thing that does define that.

A. Okay.

Q. Have you read Chapter 23 of DeVita, Cancer of the Lung?

MR. REILLY: I interpose an objection on form.

Q. (By Mr. Wither) Have you read Chapter 23 of DeVita called Cancer of the Lung?

MR. WITHER: And your objection on the form? What's the problem with the form?

MR. REILLY: If you were to read back this transcript, you will see you had an introductory portion

leading into that question.

MR. WITHER: Fair enough. You can answer.

THE WITNESS: Have I read that chapter, is that your question?

Q. (By Mr. Wither) Yes.

A. Yes, I have read that chapter.

Q. Okay. Let me read a section of that paragraph, first paragraph, and see if you agree with the statement. Okay. Under section one, Non-small Cell Lung Cancer, under epidemiology it states, Smoking and Lung Cancer, The Evidence for a Causal Association. The epidemiologic data on smoking and lung cancer fulfill the criteria for causal association including: consistency of results across studies, the strength of the association, the specificity, the correct temporal sequence between exposure and disease and the coherence of the association as evidenced by a dose response relationship.

Now, do you agree with that statement?

MR. REILLY: I object to the form of the question. I think you started this off by -- if you read this back, you'll see what you did. I object to the form of the question.

MR. WITHER: That's fine.

THE WITNESS: Do I agree with what?

Q. (By Mr. Wither) That statement.

A. No, I don't agree with that statement. I mean, I don't agree with the interpretation of that. I don't agree with the inference associated with that statement.

Q. I'm not asking you to agree with any inference. I'm asking you to agree that the epidemiologic data on smoking and lung cancer fulfilled the criteria for causal association.

A. They do not.

Q. And do you understand that epidemiologists use the following criteria to determine causality, consistency of results, strength of the association, the specificity, temporal sequence between exposure and disease and coherence of the association as evidenced by the dose response relationship?

MR. REILLY: Object to the form of the question.

THE WITNESS: That is not true. There are some epidemiologists that use that as a criteria; there are some that do not use that as a criteria.

Q. (By Mr. Wither) Doctor, name an epidemiologist that does not use that set of criteria in some form or the other for inferring causality.

A. When you read Dr. Mundt's report, I think you will discover one.

Q. Can you name any other than Dr. Mundt who is the expert witness for the tobacco industry in this case?

A. Can I name any others?

Q. Yeah.

A. Let me turn the question around. I cannot think of a single reputable scientist who believes an intimate understanding of the role of tobacco smoke in cancer has been demonstrated.

Q. Move to strike as non-responsive.

Can you think of a single epidemiologist who has published a work in the peer review literature or in a textbook that as you've testified does not accept this definition or these criteria for causal inference?

A. I've named one.

Q. Other than Dr. Mundt.

A. I think if you read a number of the references that he cites, you will find several epidemiologists that strongly question those criteria. What happens is, a few epidemiologists have decided to appoint themselves as, oh, I'm going to define causation for my specialty. And many, many other scientists don't believe that that's an acceptable definition.

Q. I'm just asking you to name one other than Dr. Mundt. Can you name one?

A. I did.

Q. You didn't give me a name. Naming means providing a name, Doctor so and so.

A. And I did, and I also said that I believe several of the other references -- if you read what is published in this particular area, a number of other people question whether or not those -- whether or not those criteria are satisfactory criteria, number one. And number two, whether or not those criteria have been adequately met.

Q. Who are those epidemiologists?

A. I don't know. I cannot name the names.

Q. Can you name a book that any of these epidemiologists who don't agree with that basic set of criteria have written?

A. No, I cannot.

Q. Would you agree that in Harrison's you will find the same or similar criteria?

A. I don't believe so.

Q. You don't? What criteria are set forth in Harrison's that you've cited?

MR. REILLY: Object to the form of the question.

THE WITNESS: What criteria about what?

Q. (By Mr. Wither) For inferring causation for epidemiologists.

A. I don't think that they deal with that topic because they deal much more with the mechanism of disease and this is not mechanism of disease. This is the shuffling of numbers. There is a fundamental difference between those

two scientifically.

Q. Does smoking cause any diseases in your opinions, sir?

A. Does smoking -- I don't believe that there is a satisfactory demonstration of the molecular understanding of the relationship between smoking and any particular disease. For me that is an absolute essential feature to identify causation. Therefore, I'm not sure that I can say that there is any single disease that is caused by smoking.

Q. By your definition does anything cause any particular disease that you can think of?

A. Yes.

MR. REILLY: Hang on a second. Object to the form of the question. It has been asked and answered.

Q. (By Mr. Wither) Name one.

A. I named one just a little while ago.

Q. Name another one.

A. I mentioned in the area of infectious disease, I think we understand this pretty well I think we understand Micobacterium tuberculosis causes tuberculosis. I think we know that Treponema causes syphilis. I think we know that the human immune virus causes AIDS. I think that we know for most areas of infectious disease I think that we know an organism and the relationship, and we understand that relationship. We understand exposure. We understand the

statistics. We understand the epidemiology of the disease. So that's the area of infectious disease.

In the area of genetic disease there are probably at this particular point at least 500 genetic diseases where we understand their causes at the molecular level.

Q. Just name one.

A. Name one? Sickle cell disease.

Q. What is the mechanism by which sickle cell disease is caused?

A. The beta-chain of hemoglobin. There is a substitution of valine in a place where there is normally a charged amino acid. As a consequence of that, in the deoxygenated form of the hemoglobin molecule it begins to gel or begins to form association with other similar molecules and forms a crystalloid gel that produces a sickling of cell which ruptures the cell membrane and can under certain circumstances bring about sickle cell crisis. And that by definition is sickle cell disease.

Q. Does it always?

A. Does it always what?

Q. Cause sickle cell disease?

A. Yes.

Q. All right. Continue on. I interrupted your answer. Is there any other disease that is caused by given exposures or conditions other than what you've already

testified to using your criteria for causation?

MR. REILLY: Object to the form of the question, but you can go ahead and answer.

Q. (By Mr. Withey) Are there any other diseases?

A. Yes, there are.

Q. Name one.

A. There are certain malignancies. As an example, we understand that certain malignancies that are caused by ionizing radiation we understand exactly what the mechanisms are that are involved, we know precisely what sort of mutations occur. We know what particular tissues they occur. We understand the relationship of the absorption of ionizing radiation by various tissues, et cetera, and so we understand the role of ionizing radiation in cancer.

Q. Which cancer?

A. Several different cancers.

Q. Name one.

A. Lung.

Q. Any others?

A. Yes, bone.

Q. What cell of origin within the lung does ionizing radiation cause?

A. Bronchial cells.

Q. Any others?

A. Probably. Probably alveolar lining cells,

probably mesothelial cells, probably.

Q. Is it your opinion that ionizing radiation causes mesothelioma?

A. I think it probably can.

Q. Is there a mechanism that is known?

A. Probably a mechanism very similar to that that has already been demonstrated in other tissues.

Q. Do you know of a single textbook that states that ionizing radiation causes mesothelioma?

A. No, I don't.

Q. Anyway, I interrupted again. Have you completed your answer of identifying by your definition what exposures or factors cause a given disease?

MR. REILLY: I'm sorry, I object to the form of the question.

THE WITNESS: If you were to give me some time, I'm sure I could come up with several others.

Q. (By Mr. Wither) If you think of any, go ahead and offer them.

In Chapter 9 of DeVita there is a chapter written by a number of epidemiologists including Dr. Joseph Framany (phonetic). Do you know who Dr. Framany is?

A. I don't recall specifically.

Q. Have you read this chapter?

A. The title of the chapter again, please.

Q. The Epidemiology of Cancer.

A. Yes.

Q. Let me just read a sentence or two and I'll ask you if you agree with me.

A. Smoking has been formally linked to cancer not only of the lung but also the larynx, the mouth, the pharynx, the esophagus, the bladder and pancreas. The wide variety of neoplasms related to smoking is highly surprising in lieu of the large number of chemicals detected in tobacco smoke, excuse me, in cigarette smoke, and delivered to a highly vascular and absorptive organ. Would you agree with those statements?

MR. REILLY: Object to the form of the question.

THE WITNESS: No, I do not agree with those statements.

Q. (By Mr. Wither) Do you agree with the following statement from DeVitta?

Epidemiologic studies have demonstrated the benefits of stopping smoking with lower risks relative to those of continuing smoking appearing within a few years of quitting.

MR. REILLY: Object to the form of the question.

Q. (By Mr. Wither) Do you agree with that statement?

A. Do I believe that studies have demonstrated a change in risk ratios as a consequence of stopping smoking?

Q. I just read it. I can read it again. I just asked if you agree with what is said in DeVitta.

MR. REILLY: Object. I object to the form. Why don't you let him look at it and he can read it?

Q. (By Mr. Wither) Do you need to look at it or do you want me to repeat it?

A. Read it.

Q. The epidemiologic studies have demonstrated the benefits of stopping smoking with lower risks relative to those of continuing smoking appearing within a few years of quitting.

A. No, I disagree.

Q. And what body of work or studies do you rely upon in contesting with that, Doctor, as is said in this chapter in DeVita if any?

A. I rely upon an enormous body of work that represents the areas that I have studied over the course of the past many, many years.

Q. Can you name any such studies that has challenged the conclusion that epidemiologic studies have demonstrated the benefits of stopping smoking lowers relative risks within a few years?

A. That's not what the studies -- that's not what you read.

Q. Well, let me read it again. I'm asking if you can identify a single article in the medical literature, or study or book that can test the conclusion reached here that epidemiologic studies have demonstrated the benefits of stopping smoking with lower risks relative to those of continuing smoking appearing within a few years of quitting.

MR. REILLY: I object to the form of the question. Why don't you let him take a look at it.

THE WITNESS: The problem is the inference associated with quote, "the benefit". I don't challenge whatsoever that there have been multiple studies that have demonstrated that as a consequence of stopping smoking the risk ratio for the occurrence of cancer has decreased. I don't challenge that idea whatsoever. I challenge significantly the interpretation of the word benefit which I feel is inference that indicates in some sort of way a causal relationship between those two events.

Q. So let me see if I understand correctly. You agree that there are many studies that show that the relative risks of smoking and let's say lung cancer go down after people stop smoking, correct?

A. Absolutely.

Q. But you don't believe it has anything to do with the fact that they stopped smoking, correct?

A. No, I think that the stopping smoking was the

direct approximate cause in the changing of risk ratio.

Q. No, I'm asking do you think it has anything to do with it at all?

A. Yes, it does.

Q. What does it have to do with it?

A. It has to do with the statistical association.

Q. In other words, if you are -- if a group of people are smoking, they have a relative risk of lung cancer of let's say 20.

A. Yes.

Q. Fair enough?

A. Fine.

Q. And let's say then they stopped smoking, do you agree that the relative risks go down --

A. Yes.

Q. -- within a few years of quitting, correct?

A. Yes.

Q. And I'm asking you whether you think the fact that they stopped smoking has something to do with the fact that the relative risk of developing lung cancer has gone down?

MR. REILLY: That's not the question you are asking.

THE WITNESS: That's not the question you asked me. If you are asking me now, yes, I think it has something to do.

Q. (By Mr. Withey) What does it have to do?
A. I wish I knew. If I knew, I would publish that study.
Q. Do you think there has been studies published that describe what smoking has to do with decreased relative risks?
A. I mean, I do believe there are such studies, sure.
Q. Have you read those?
A. Yes.
Q. Are you familiar with them?
A. Yes.
MR. REILLY: I object to the form of the question.
THE WITNESS: Some of it, at least.
Q. (By Mr. Withey) Do you believe there is evidence for dose response relationship for smoking and lung cancer?
A. I believe there are studies that demonstrate that there is a change in the relative risk with the change in the dose, yes.
Q. Does the risk for lung cancer increase with the number of cigarettes smoked?
A. Typically that's one of the gauges that is used.
Q. Duration of smoking?
A. Typically that's used.
Q. Do you believe that the risk for lung cancer increases the earlier someone starts smoking the same, age

of onset?

A. That has also been a risk factor that has been demonstrated, yes.

Q. And you believe it is true, correct?

A. Yes.

MR. REILLY: Object to the form of the question.

Q. (By Mr. Wither) Are you familiar with literature demonstrating that cigarette smoke constituents are carcinogenic?

MR. REILLY: Object to the form of the question.

THE WITNESS: I'm familiar with the fact that there has been compendiums of chemical compounds that have been identified in cigarette smoke, some of which have been identified as being the independent carcinogens.

Q. Same question as mutagens.

MR. REILLY: Same objection.

THE WITNESS: Same answer.

(Thereupon, there was a brief recess.)

Q. (By Mr. Wither) Ready?

A. Yes, sir.

Q. Before the break I asked you whether there are carcinogens in tobacco smoking and you answered there are some, correct?

MR. REILLY: Object to the form of the question.

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THE WITNESS: There are compounds that have been identified as carcinogens in tobacco smoke, yes.

Q. (By Mr. Wither) Which ones are there?

A. Which ones are there?

Q. If you know.

A. There have been lists of these sort of things published. I think in one of the early Surgeon General reports there was a list of some, I don't know, 60, 80 compounds. Several of these compounds have extraordinarily unlikely roles as compounds which cause cancer. There are some of the compounds that have been listed as cancer-causing compounds that actually occur as part of ordinary human metabolism. There are other compounds which have been identified on that particular list which are found rather commonly in the human diet, and then there are some compounds that are clearly much more likely to cause cancer in animals.

The group of compounds which are most frequently associated with carcinogenesis are the polycyclic aromatic compounds, benzanthracene, benzopyrene and several other related isomers.

Q. All right. And are Nitrosamines carcinogens?

A. It is a very interesting question. I'm going to answer it by saying that there are a substantial number of those in every hotdog, every slice of corn beef, every slice

of salami, et cetera, that we eat. F.D.A. has allowed those compounds to occur without changing any of the rules with respect to those particular compounds. As far as I'm aware of, if they cause cancer, they are not very potent carcinogens. If you take them in isolation under particular laboratory conditions, you can demonstrate that exposure to those compounds will produce certain kinds of cancers in certain animals.

I haven't attempted to be circumvent. I've just tried to qualify my answer in that.

Q. I move to strike as non-responsive.

Are you aware of any studies showing the interactive effect of certain chemical substances, carcinogens and tobacco smoke and other substances such as asbestos?

MR. REILLY: Object to the form of the question.

THE WITNESS: I'm not sure that I understand the question.

Q. (By Mr. Wither) Well, do you understand the notion of interactive effect of carcinogens along with viral and host factors? Do you understand by interaction --

MR. REILLY: Object to the form of the question.

THE WITNESS: I think I understand what your question is. If your question is do I understand something that is referred to as interaction among risk

factors, then yes, I understand that.

Q. (By Mr. Wither) Let me ask you, do you agree with this statement Tobacco smoke and asbestos through their ability to induce inflammation and lipid peroxidation cause oxidative DNA damage?

MR. REILLY: Object to the form. Doctor, if you need to see any of these things --

THE WITNESS: Do I agree that that has been demonstrated?

Q. (By Mr. Wither) Do you agree with that statement?

A. Do I agree with that particular statement?

I don't have a basis to agree or disagree with that statement.

Q. On page three of, I guess it is page three of your report, you talk about the Mechanism of Action for Development of Human Diseases and Cancers; is that correct?

A. Yes.

Q. Is it your testimony, and correct me if I'm wrong, that in order to infer causation from various studies you have to find a mechanism by which an agent causes the disease outcome?

A. Yes.

Q. And again, you quote a couple of studies, you say animal inhalation studies have not supported the claim that smoking causes lung cancer, emphysema or cardiovascular

disease; do you believe that to be true?

A. Yes.

Q. Are you talking about inhalation studies on animals?

A. Yes.

Q. And do you understand it is difficult to get dogs to smoke?

MR. REILLY: Object to the form of the question.

THE WITNESS: In the same way that people smoke, yes.

Q. (By Mr. Wither) And there has certainly been human studies of pathology of lung cancer and smoking, correct?

A. Yes.

Q. Have you read that literature?

MR. REILLY: Object to the form of the question.

THE WITNESS: Yeah. I can't imagine how you could ask that question based on everything else that I've said that I've read. Yeah, I guess so. I would have had to have read that to have answered most of what I've already answered.

Q. (By Mr. Wither) Do you understand there has been pathology studies that have identified the constituent elements of smoking in lung cancer, lung tissue --

MR. REILLY: Object to the form of the question.

Q. (By Mr. Wither) -- in humans?

A. I'm not aware of any studies.

Q. Have you published in the area of inhalation studies or animal inhalation studies?

A. I have not.

Q. You do understand that animal inhalation studies don't take in the smoke as humans do, correct?

A. I understand that the mechanism that is used to provide exposure in animals is different than it is with humans, yes.

Q. What do you understand the mechanism of exposure to be?

A. There have been a number of different means by which animals have been exposed, and none of them have been the same as ordinary smoking.

Q. What's the difference?

MR. REILLY: Object to the form.

THE WITNESS: What is the difference?

Q. (By Mr. Wither) Yeah, you say they are not the same as. What is different about the way the animals breathe in the smoke and the way the humans do?

A. Typically one of the ways is to place an animal in a closed container that is filled with smoke, and so they breathe the smoke when they are breathing the ambient air. There have been other studies where they've actually had the animals breathe through an apparatus that caused the intake

of smoke when they breathed from a cigarette.

Q. Would you agree that the fact that the animals in inhalation studies don't smoke cigarettes the way humans do would be a limitation of those studies?

A. That could be a limitation, yes.

Q. Do you believe it is in fact a limitation?

A. No, no.

Q. Why?

A. I think it is sort of like it doesn't make very much difference if I take my liquor with you right hand, or my left hand, or through a straw, or mixed with water or whatever, if I'm going to get the same exposure, I think the idea is, you know, does the animal -- actually, lungs are the lungs of the animal exposed to tobacco smoke at a dose that is comparable and at a distribution within the lungs that is comparable to what we see in smokers, and I think it is fairly close.

Q. Well, what study could you cite, if any, since you've cited animal inhalation study, that the study states that the mechanism of breathing in the air in a container containing smoke is the same as the way in which humans smoke cigarettes and breathe the smoke directly and deeply into the lungs?

MR. REILLY: Object to the form of the question.

THE WITNESS: I can't cite you a specific study.

I think on its face if somebody believed that there was a radical between the two, they would have never done the study.

Q. (By Mr. Wither) Well, do you believe that the studies that have looked at animal inhalation have found that the difference is in the way animals breathe compared to the way humans breathe, and smoke is a limitation on their study and its applicability to humans?

MR. REILLY: Object to the form of the question, has been asked and answered in a slightly different way.

THE WITNESS: I think there are people whom regard that as a possible interpretation of the outcome of the studies, yes.

Q. (By Mr. Wither) Are you familiar with skin painting studies?

A. With some, yes.

Q. Have you published any skin painting studies?

A. I have not.

Q. Have there been positive skin painting studies showing increased carcinogenic activity in exposure to the tars that are painted upon animal skins?

A. Yes, there have.

Q. Can you cite a couple of the leading possible studies?

A. No, I can't.

Q. Can you cite any of the supposedly negative studies or studies that have quote, "failed to prove that smoking increases or causes lung cancer"?

MR. REILLY: I object to the form of the question.

THE WITNESS: What is your question again?

Q. (By Mr. Wither) Can you cite -- I believe you testified there have been positive studies.

A. Skin painting studies you asked about?

Q. Yes.

A. I'm not aware of any skin painting studies that have demonstrated a relationship that skin painting causes cancer of the lung, which is what your second question was.

Q. No, let me clarify it in light of your problem with it.

You've said there are positive studies showing that skin painting, i.e., putting tar on the skin of animals, increases carcinogenic activity, correct?

A. That animals who are treated with that develop skin cancer, a certain number of them, yes.

Q. And I take it you can't name those studies; is that right?

A. I can't cite the specific references to them right now, no.

Q. And you haven't cited any of those in your bibliography, correct?

A. Not to my knowledge.
Q. Are there any negative studies?
A. Yes, there are.
Q. Can you cite any of those?
A. I can't cite those either specifically.
Q. You didn't put those in your reliance materials?
A. I didn't put those either.
Q. Now, you make the statement that the failure of animal toxicology studies to consistently produce cancer suggests that other factors should be considered, correct?
A. Yes.
Q. Now, other factors should be considered for what?
A. Should be considered as to their role in the development of cancer or in other disease processes.
Q. Well, do you believe that there is some other unidentified factor out there that is causing smokers to die of lung cancer up to 20 times the rate of non-smokers?
MR. REILLY: Object to the form of the question.
THE WITNESS: Do I believe that there is some other factor?
Q. (By Mr. Wither) Yes.
A. I think there are multiple other factors. I think that what we are looking at is one, a row of multiple factors being involved. I don't think that tobacco smoke in and of itself has been demonstrated, and it may never be

demonstrated to be quote, "the cause of any particular disease".

Q. I'm asking you whether you believe that there is some other unidentified factor that is causing smokers to die of lung cancer at 20 times the rate of non-smokers?

MR. REILLY: Object to the form of the question. That has also been asked and answered.

THE WITNESS: First of all, I don't know where any of this data would come up with respect to 20 times. So if I have to qualify my answer with respect to 20 times, then I'm going to have to say, I'm not aware of any such studies that indicate anything approaching that.

Q. (By Mr. Withey) You are not aware of any studies showing that the relative risk of lung cancer in smokers is 20 times that of non-smokers?

MR. REILLY: Object to form.

THE WITNESS: For every one of those studies I can show you ten others that indicate a much lower risk factor.

Q. (By Mr. Withey) I thought you testified you know of no study that found 20 relative risks?

A. I didn't say that.

MR. REILLY: I interpose an objection to the form of the question.

Could you read the last question back?

(Thereupon, the reporter read back the last question and answer.)

Q. (By Mr. Withey) Doctor, we've read back to you the last couple of questions and answers. Do you have any reason to withdraw any of your answers given previously?

A. I'm not withdrawing any of my answers given previously.

Q. Okay. What is the largest epidemiologic study ever been conducted?

A. The largest?

MR. REILLY: Wait a second. On any topic?

MR. WITHEY: Yes.

MR. REILLY: Object to the form.

Q. (By Mr. Withey) If you know.

MR. REILLY: Relevancy.

THE WITNESS: I'm aware of a number of studies that have involved tens of thousands of people.

Q. (By Mr. Withey) Are you aware of a study that has involved a million?

A. A million?

Q. Yes.

A. Not that I can recall.

The Mr. Fitz (phonetic) study had somewhere in the facility of 50,000 or so. There have been some Sweedish and Finnish studies that have involved numbers approaching that,

but I'm not aware of any epidemiological study that fits my definition of study that involves a million people.

Q. So what is the relative risk of smoking and lung cancer in males as reported by the U.S. Surgeon General, do you know?

A. What is the relative risk?

Q. Yes.

A. Depends on which particular group you are talking about.

Q. I said as reported by the Surgeon General for males.

A. I have no idea what was reported, and I would imagine that I could find several different general reports and several different numbers in the Surgeon General's report which aren't to that particular statistic.

Q. Have you read the 1989 Surgeon General's report, Chapter 3?

A. I have read most of the 1989 report.

Q. Have you read the relative risks of the Surgeon General's report for lung cancer in men?

A. I imagine that I have if I read the report and if there are some statements there.

Q. And do you still stand by your statement that there are no studies reported that have even come close to a relative risk of 20 for lung cancer in men?

MR. REILLY: Object to the form of the question.

THE WITNESS: I'm not aware of any. Let me go back to my previous answer. For every study that you can find that indicates a relative risk of 20 for smoking, I can produce another ten, and I will guarantee that, that indicate a much smaller number, number one.

Number two, those relative risks studies that you may wish to refer to, I think any qualified scientist would have to say they were an embarrassment as an example of the capabilities of modern science.

Q. (By Mr. Withey) Do you know of any studies that show a negative association between smoking and lung cancer, Doctor?

A. No, I don't.

Q. What is the low relative --

A. Actually, I think I do know of one. There have been some recent convenient studies done by H.M.O. with respect to personal habit and the cost of medical care over short term analysis, and these studies have -- have shown that there is decreased cost of care sometimes for some things which are regarded as bad habits. And a lot of other people regard this as an example of bad inferences taken from statistics. But nonetheless, there is such published data.

Q. Now, I think I asked you a question about --

A. And I think I answered it.

MR. REILLY: Wait.

Q. (By Mr. Withey) I think I asked you a question about the relative risk of smoking and lung cancer as being below one, and your answer was an H.M.O. study on personal habit showed a decreased cost of healthcare.

A. Uh-huh.

Q. What I'm asking you is, does that study contain --

A. Any data -- I'm sorry, excuse me.

MR. REILLY: Why don't you start the question over.

Q. (By Mr. Withey) I'm not going to ask the question. I can't ask questions if you are going to interrupt me.

If there were positive skin painting studies, would you then say that smoking causes any particular disease?

MR. REILLY: I'm sorry, I object to the form of the question.

THE WITNESS: I don't understand any relationship between skin painting studies and some other disease.

Q. (By Mr. Withey) Well, I'm just reading from your report. Let me read you a question, I mean, your statement, to see if you want to change your answer to the last one you just gave.

MR. REILLY: I object to the instruction. What are you talking about? Why don't you read it to him.

MR. WITHEY: Why don't you let me ask the question and then you interpose your objection. In the Western District of Washington, you may not be familiar if you come from Miami, Judge Dwyer has an order and the order states -- I want to inform you if you continue to violate it you will know you are in violation of the order. It says you can --

MR. REILLY: You don't have to read me -- don't read me the Federal Rule.

MR. WITHEY: I don't appreciate counsel interrupting me. Let's go on with the deposition. The rule is you can interpose the objection, you are not to speak. You are not to ask the witness to ask another question.

MR. REILLY: I invite this court or any other court to read this transcript. That's exactly what I've done.

MR. WITHEY: You've done this in your last interruption.

MR. REILLY: Why don't you read the last question?

Q. (By Mr. Withey) I want to know -- I'm reading your report and your answer as to the relationship of skin painting studies to cancer other than skin cancer, okay,

Likewise animal skin painting studies have not proven that smoking causes lung cancer. You stand by that statement?

A. I do.

Q. And do you still believe that there is no relationship between skin painting studies and other cancers other than skin cancer?

MR. REILLY: Object to the form of the question.

THE WITNESS: Do I believe that there is no relationship?

Q. (By Mr. Withey) Yes.

A. I think that that's not what I said. I said that the relationship hasn't been demonstrated. Do I believe there is a possible relationship? Yeah, there is a possible relationship.

Q. Now, you have in your report a section on misdiagnosis, correct?

A. Yes.

Q. And is it your testimony that all of the reported elevations in mortality rates in relationship to smoking found in the 1989 Surgeon General's report are entirely accounted for by errors in cause of death determinations?

A. Would you ask that one more time, please?

Q. Is it your testimony that all reported elevations in mortality rates in relationship to smoking, that is, all relative risks in excess of one as reported in Chapter 3 of

the Surgeon General's report 1989 are entirely accounted for by errors in the cause of death determinations?

A. No, that's not my testimony.

Q. Is it your testimony that if the cause of death had been determined in a manner that you would find acceptable, we would find out that the death rates in smokers from lung cancer, heart disease or C.O.P.D. are the same as in non-smokers?

A. No, that's not my testimony.

Q. Is it your testimony that no death can be attributable to smoking?

A. No, that's not my testimony.

Q. Do you use ICD-9 coding in your hospital?

A. Yes, we do.

Q. Do you use it to bill Medicare, Medicaid in Florida?

A. Have to.

Q. How widespread in region in which you practice pathology is the use of ICD-9 coding?

A. It is required for billing purposes nationwide.

Q. Therefore it is widespread, correct?

A. Right, correct.

Q. Have you yourself performed audits or studies to check the accuracy of ICD-9 codes in your hospital?

A. I have.

Q. You've testified about that previously, correct?
A. Yes.
Q. Are you aware of any published study that have shown that the use of ICD-9 overstates the numbers of lung cancer?
A. That the use of ICD-9?
Q. Yes.
A. No.
Q. And I would ask you the same question as to the following cancers, but if there is a different answer, let me know.
Cancer of the esophageal track, lip cancer, pharynx cancer, same answer?
A. Yes.
Q. C.O.P.D., emphysema, coronary heart disease, cerebral vascular disease, same answer?
A. Yes.
Q. You've cited in your text, or excuse me, in your list of reliance materials the article by Ronald Cechner, Misdiagnosis of Bronchogenic Carcinoma; is that correct?
A. Which particular reference, please.
Q. Number five under misdiagnosis.
A. Yes.
Q. Now, you've considered this a reliable article, correct?

A. I do.

Q. Have you read it?

A. Yes.

Q. And let me ask you if you agree that this is one evident result reported by Dr. Cechner, and if you need to look at the article to confirm I'm reading it correctly, please ask me to do so.

A. Okay.

Q. Within a selective study group of 415 cases diagnosed as bronchogenic carcinoma either clinically on autopsy or both, the disease was diagnosed accurately in 260 cases, overdiagnosed in 38 cases and underdiagnosed in 117 cases or 28 percent. Do you agree that that was a finding of Dr. Cechner?

A. I think that that's -- if you are reading from the report, yes, I agree that that was a finding.

Q. Okay. You understand that in general healthcare payers must pay claims that have been properly presented including using ICD-9 codes, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: I think I understand the role of ICD-9 code and third-party payers reimbursement, yes.

Q. (By Mr. Withey) You understand that properly presented claims for payments must be paid generally under contract, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: Yes.

Q. (By Mr. Withey) Do you expect the healthcare payers to audit every healthcare provider to determine in each instance whether a proper ICD-9 code was written down?

MR. REILLY: I object to the form of the question.

THE WITNESS: No, I don't expect.

Q. (By Mr. Withey) You understand there would be significant administrative costs in trying to conduct such an audit.

MR. REILLY: Same objection.

THE WITNESS: I do.

Q. (By Mr. Withey) Is it your opinion that the supposed miscoding of ICD-9 codes has caused the Plaintiffs in this case in Washington State to pay more for the smoking related ICD-9 codes than they should have paid?

MR. REILLY: Object to form.

THE WITNESS: First of all, I'm not aware of any of the specific data, number one. Number two, for the vast majority of third party payers, whatever is reimbursed has nothing to do with whatever the ICD-9 code is. It is completely irrelevant for almost all private insurances. It is only relevant with respect to Medicare claims, with respect to how cases may be classified under the D.R.G.

And again, that only applies to inpatients in the case of Medicare. Most Medicaid reimbursement for most states, I have no idea what it is in Washington, are totally independent of whatever the ICD-9 codes are.

Q. (By Mr. Withey) Do you understand that the healthcare payers in this case have had presented to them claims that contain ICD-9 codes?

MR. REILLY: Objection to the form of the question.

THE WITNESS: Most third-party payers require ICD-9 codes.

Q. (By Mr. Withey) I'm asking you whether you believe any supposed miscoding of ICD-9 code has caused the healthcare payers that are Plaintiffs in this case to pay more for the ICD-9 codes related by the Surgeon General to smoking than they should have paid; is that your testimony?

MR. REILLY: Same objection.

THE WITNESS: I have a little problem understanding the question. If the question is, is there an overrepresentation of certain ICD-9 codes that one way or another the claim, which is independent of the ICD-9 code, that if you were to count those particular claims with various ICD-9 codes and you were to attribute cost of those particular claims to those ICD-9 codes, has there been an overcounting of certain

of them? Absolutely.

Q. (By Mr. Withey) Of certain of them? What do you mean?

A. Certain ICD-9 codes in other words.

Q. You've answered the question.

A. I'm not sure that --

Q. I'm asking you whether there has been -- whether the Trust Funds in Washington State in your opinion have paid more than they should have for smoking-related diseases due to the supposed miscoding of ICD-9?

A. I don't understand. If they have paid more?

MR. REILLY: Let me interpose an objection to the form of the question.

THE WITNESS: I don't understand what you mean by paid more for.

Q. (By Mr. Withey) What I mean, if you are not familiar with how the system works with the Trust Funds, I understand that. So if you are saying, I don't really know how the Trust Fund pay their claims and how it is related to ICD-9, then I need to know that.

Are you familiar with the system utilized in this case?

A. I know how most third-party payers reimburse claims.

Q. Are you familiar with the system used by the

Plaintiffs and their healthcare providers in this case?

A. Not specifically, no.

Q. Have you studied that in any respect?

A. No, I have not.

Q. Have you studied any data from the healthcare providers in Washington State as to how they utilize ICD-9 codes in claims? Have you done any studies of that?

A. Have I ever done a study of that? No.

Q. Have you read any articles or documents about how much the healthcare payers pay the claims for ICD-9 codes in Washington State?

A. I haven't. I would be shocked to discover it was any different than any other state.

Q. I'm just asking if you've read any documents, Doctor. And I'm asking you whether in your opinion, for instance, that the supposed miscoding of ICD-9 codes has required the healthcare payers, these Plaintiffs in this case --

A. Uh-huh.

Q. -- to overpay for the smoking-related diseases that they've been billed for?

MR. REILLY: Object to the form of the question.

THE WITNESS: I answered the question earlier. I'm not aware of a single third-party payer that pays for any diagnosis. They pay for the care of patients,

all right. And the care of patients may be attributable to an ICD-9 code, and there may be misclassifications of the ICD-9 codes.

And if you are inferring that they have paid more for smoking-related ICD-9 codes, if that's your inference, then I would say yes.

Q. (By Mr. Withey) For which diseases?

A. For practically all of the diseases that have been nominally linked to smoking.

ICD-9 codes by themselves do not, with one or two very small exceptions which are recent editions to the ICD-9 coding system, don't identify smoking related or smoking-caused diagnoses. They just diagnose.

Q. But they do identify, for instance, lung cancer, correct?

A. They do identify lung cancer.

Q. And you certainly would agree, whether you call it an embarrassment or not, that the Surgeon General has identified lung cancer as one of the diseases that is related to smoking, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: I agree that the Surgeon General has rendered such a report, yes.

Q. (By Mr. Withey) Those are the diseases I'm referring to. And you will understand that the Surgeon

General has used ICD-9 codes in identifying those diseases, correct?

A. No, I don't think the Surgeon General has ever done anything with that. The Surgeon General has various advisory panels and so forth where they have used ICD-9 along with several other kinds of diagnoses schemes for epidemiological studies.

Q. It is not in the Surgeon General's report of 1989, the use of ICD-9 codes?

A. I have no idea. I don't have specific recollection whether it is or isn't.

Q. You say for practically all diseases. Which diseases do those misclassifications or miscoding not occur that are within the diseases identified by the Surgeon General as smoking related?

A. Virtually every disease is smoking related or not smoking related. There is a significant error rate with respect to the diagnoses codes which are used to associate a particular episode of care, and this certainly applies, and it applies to a large measure, with some of the diagnoses that have been presumably smoking-related diagnoses.

And in my expert disclosure I cite a number of studies that document exactly that.

Q. Is there any other study that you are familiar with or -- strike that.

When you say there is an error rate for each disease, is there a different magnitude of that error?

A. Absolutely.

Q. And for each disease is there a different direction of the error?

A. I think if you qualify the setting in which the particular diagnosis is applied, probably yes --

Q. Okay.

A. -- in terms of underdiagnosis, overdiagnosis, whatever.

Q. Have you read any study of the issue of miscoding using ICD-9 codes and lung cancer?

A. Yes.

Q. You cited a study in your materials?

A. Yeah.

Q. Which one?

A. As a matter of fact, I think the one you just referenced.

Most of the case findings coding system that are used in hospitals, most of the autopsy studies used as case findings to measure diagnostic accuracy, most of those are based against the actual codes that were used in the case or the ICD-9 codes.

Q. I just read one. Since you cited it, the only article that I see in your review that looks to the issue of

misdiagnosis of lung cancer is the Cechner article.

A. There are others.

Q. Show me which one, then.

The Chak article, okay.

A. Yeah.

Q. Number ten.

A. Number six was another study, a series of autopsies involving the comparison of clinical diagnosis and results found at autopsy and the actual diagnosis at autopsy. Now pathologists do not use ICD-9 codes.

Q. Right. Now I'm talking about ICD-9 codes.

A. But what happens is the case finding, number one, okay, is also a study.

Q. But I'm asking about ICD-9 codes.

A. Well, what I can't recall now is most of this sort of thing isn't in the summary. Most of it is in the methodology that you look at. When you look at the studies, generally speaking, they look at case findings and comparison of clinical diagnosis. They reference whatever the hospital coding system or the clinical coding system or the abstracted diagnosis is.

Q. Do you understand my question?

A. I do. I think I do.

Q. Let me just be very clear. My specific question is, which studies that you've cited in your list of

materials of study, --

A. Yeah.

Q. -- articles, deals with the issue of miscoding, that is, the error of ICD-9 coding, and specific to lung cancer?

A. If you are asking which particular study is that the principle part of the study, there may be only one. On the other hand, if one looks at the other studies where that is clearly a related issue, there is more than one.

Q. Well, at least there is the Cechner study. You would agree that the direction of the error was to underdiagnose cases of bronchogenic lung cancer, correct?

A. I would actually have to look at that study completely to be able to --

Q. Fair enough.

A. -- determine that.

Q. I just asked you the question, and I read you from the abstract and you said you believed it to be true.

A. I believe that's a faithful rendering of what is in the abstract, yes.

MR. REILLY: Why don't you just let him see the study?

Q. (By Mr. Withey) Let me ask the question the way I want to ask it. I will show you the study.

MR. REILLY: For the record, he has asked to look

at the study and you invited him to do that.

MR. WITHEY: I'm going to let him see the study.

Q. (By Mr. Withey) I'm going to let you see the study, Doctor, but I want to read you the sentence that I asked you to testify about.

Within a selected study group of 450 cases diagnosed as bronchogenic carcinoma either clinically at autopsy or both, the disease was diagnosed accurately in 260 cases, overdiagnosed in 38 cases and underdiagnosed in 117 cases. Do you understand that that was the result of the study? And let the record show I'm handing the Doctor the Cechner article that he cited in his bibliography.

A. A major point of this particular article is that the underdiagnosed cases of cancer occur in non-smokers. That's the major thesis of this article.

Those particular cases of underrepresented diagnoses were in people who were non-smokers.

Q. Well, which page does that refer to?

Okay. First of all, you will agree without getting too much in here that there were more, you said there were more underdiagnosed than there was overdiagnosed, correct?

A. I didn't say that.

Q. I mean, you read this, correct?

A. I just read from the article.

If you read the next sentence, it says misdiagnosis occurred in female patients nearly twice as frequently as male patients. And as we all know that the relative risks for most all of the studies of the association of cigarette smoking and cancer indicate that for males it is a much higher relative risk than it is for females. And yet in this particular study there were more females, twice as many as there were males, and obviously this is a group of non-smokers, a much larger group of non-smokers. As a matter of fact, this is even mentioned here.

Q. How many female non-smokers were in the study then, Doctor?

A. I'm not sure that they -- let me see here. There is a problem, of course, there is a --

Q. I'm just asking how many female non-smokers were there in the study if you can tell me?

A. It can't be answered because there is a significant number of the females in the study, 24 percent apparently, for which there is no history one way or the other with respect to smoking, okay. Among those, though, where one has a qualitative or a quantitative estimate, there ends up being apparently up to 71 percent.

Q. Seventy-one percent what?

A. Is the history with respect to -- with respect to

smoking, and that's not broken down specifically for females.

Q. Well, 71 percent were smokers or non-smokers?

A. The percentage is here. They take the various groups and then add together the sexes, and I'm going to have to go through here and separate out the particular numbers.

Q. Seventy-one percent of both sexes were smokers or non-smokers, Doctor?

A. In this particular case where there was among the no data on smoking and non-smokers there were 15 women and taking the largest category of qualitative and quantitative measures there were 22 women.

Q. Could you just answer? You used the word 71 percent, and I'm just asking you whether the 71 percent were non-smokers or if the 71 percent were smokers, Doctor?

A. Seventy-one percent of the males and females in the particular category of where they have an accurate diagnoses were regarded as being smokers.

Q. Thank you.

A. Okay.

Q. Is it your opinion that this study shows that the misdiagnosis, excuse me, that the underdiagnosis of bronchogenic lung cancer occurred more in non-smokers than in smokers?

A. Absolutely.

Q. All right. And tell me where that finding of this study is shown. In other words, do the authors make this conclusion or is this your conclusion?

A. The authors make this conclusion.

Q. Okay. Read the sentences that the authors make that conclusion.

A. The data indicate that bias due to the presence of factors such a smoking and certain signs and symptoms including coughing promotes a more aggressive approach to diagnosis and treatment. It is also clear that patients who have the disease and do not present the symptoms and do not reveal a history of smoking or coughing are less likely to be diagnosed. That's on page 198 --

Q. Let me see.

A. -- of the study.

Q. Page 198?

A. Yeah, it is on the bottom. What I just read to you --

Q. Yes.

A. -- is on the right-hand side at the bottom.

Q. Well, is there a statistical significance to that finding?

A. Yes, absolutely. And as a matter of fact, it is consistent with several other reports.

Q. I didn't ask you about other reports.

A. Well, we are talking about the understanding of statistics. And one of the things that you said is part of the bible of understanding statistics is consistency, and I said there is consistency there.

Q. I didn't ask you that. I asked you whether this finding is quantified, that you just read, is quantified.

A. I believe it is.

Q. All right. And does that quantification of that show statistical significance?

A. I believe so.

Q. Okay.

Q. But that study would include not only smokers but also those who have the sign or symptoms of coughing, correct, in the part you read; is that correct?

A. What they attempt to understand is how bias is developed with respect to the way diagnoses are made. And one of the ways in which we bias ourselves as people is we take various clues. And one of the clues that we take with respect to something wrong with the lungs is coughing. However, a person can have something wrong with their lungs without having a cough.

Q. And a person who coughs is not necessarily a smoker.

A. That's correct.

Q. And the category they used was both coughing and/or smoking or no coughing, no smoking, correct?

A. They used both.

Q. Right. And they show the data for both, correct?

A. Correct.

Q. And they combine the data of smoking and coughing to get to the results?

A. That I don't recall specifically. I doubt it.

Q. Well, let me read it to see if you would agree.

A. I know what that sentence says. I think that they looked at those independently.

Q. They say it is clear that patients who have the disease and do not present the symptoms or do not reveal a history of smoking or coughing are less likely to be diagnosed.

A. Correct.

Q. So it is your understanding that all the cases of this failure to be diagnosed with smokers or smokers and people who had coughs?

A. I think -- my interpretation of that "or" that you are referring to in there separating those two groups is that that's an exclusive "or" not an inclusive "or".

Q. Okay. Answer my question. Do you believe that the people who are less likely to be diagnosed are people who include people who smoke, excuse me, did not reveal a

history of smoking or have presented with a symptom of coughing?

A. And who do not have a symptom of coughing, those two.

Q. Yes.

A. And I believe those are independent, and I believe that the figures are actually there that would indicate the independence of this study. I'm not sure when they are independent whether or not it is still a chief significance or whatever, and the study is obviously clouded by some patients where they don't have the data, et cetera, et cetera.

Q. This is not an ICD-9 miscoding study, correct?

A. It doesn't give the details, unfortunately. It says Demographic data clinical diagnoses recorded in the autopsy report were rendered prior to autopsy and autopsy diagnosis was prepared for computer analysis using methods described elsewhere. So I don't know exactly what coding system they used for clinical diagnosis that they used for the comparison purposes. The diagnosis that was used by the pathologists for their studies was SNOP diagnosis.

Q. Okay. Do you believe that cause of death determinations also have misdiagnoses?

A. Oh, absolutely.

Q. Is it your opinion that the misidentification of

lung cancers as primarily versus secondary occurs to a greater extent during ICD-9 coding by healthcare providers and by nosologists who determine cause of death in the cancer prevention study data?

MR. REILLY: Object to the form of the question.

THE WITNESS: As far as I know, the presumed nosologists don't do any basic studies. They don't see the patients. They don't read the records. They only take statistical data. As far as I know the statistical data that they take normally ends up being ICD-9 coded although it could be other sources of data that are used in such studies.

Do I believe in that particular group that there is a relatively poor accuracy with respect to diagnoses of causes of death? Yes, I think there are multiple studies that indicate that.

Q. (By Mr. Withey) I guess I'm not questioning you on that. I'm asking whether you believe either the magnitude or direction of the misdiagnosis error is somehow greater or less for ICD-9 coding done by healthcare providers as compared to nosologists who use such diagnosis on death certificates?

A. They don't use any of the -- I don't know, do you think that these other people who use some other means of coding -- I don't understand what you mean, I guess.

Q. I'm asking you whether the magnitude and direction of the error that you've testified to in coding in ICD-9 coding --

A. Yeah.

Q. -- is greater or less than this supposed misdiagnosis of nosologists who determine cause of death?

A. Okay. I don't know what nosologist means in your particular definition, so you have to define it.

The only people who I know who determine cause of death are either physicians or coroners. Now, if those are nosologists, then --

Q. That's what I'm referring to.

A. -- Then so be it.

Q. That's what I'm referring to.

MR. REILLY: Let me interpose an objection to the preceding question.

THE WITNESS: Generally speaking the people who identify cause of death, particularly coroners, notoriously suspect their diagnosis, number one. Number two, they don't use any coding system, generally speaking, other than some really broad category like maybe quote "cancer".

As far as I know, there aren't -- there are very few states, if any, that require a coroner diagnosis as cause of death to be an ICD-9 code. ICD-9 codes are not

a very good coding system for that.

Q. (By Mr. Withey) Okay.

Are you done?

A. So, yeah, if I had to guess, I would say probably the errors are greater in that area of diagnosing.

Q. Part of that was responsive. I'll move to strike the parts that weren't.

The paragraph starting on the second page of your report you list a number of different kinds of lung cancer, including those that you indicate are quote, "not necessarily associated with smoking", do you see that?

A. Yes.

Q. Are you saying that the other types of lung cancer are necessarily associated with smoking?

A. No.

Q. Well, then what does it mean to say that some lung cancer types -- what does it mean to say that some lung cancer types are not necessarily associated with smoking if the other ones aren't necessarily associated with smoking as well?

A. Okay. The word association has to do with statistical association, and there are certain histologic types of lung cancers which have a higher relative risk, that may be confusing, but have a higher relative risk relative to the other histologic types, and there is at

least one major histologic type that demonstrates little or no relationship to smoking.

Q. Which one?

A. That's bronchoalveolar cell carcinoma.

Q. What is the relative risk of smoking and bronchoalveolar cell carcinoma?

A. In a number of studies not statistically different than one.

Q. Which studies?

A. Again, those are studies that I have cited, and there is at least three of them here that will get into that particular issue.

I'm pretty sure that the paper referenced number two is one such study, but there are actually -- let me see if I can -- there is one down here. Study number eight deals specifically with that particular issue. It also by the way provides references to some other studies on here, but I'm pretty sure that McFarlane in one of his studies, it is either one, two or three, brought up that particular issue of bronchoalveolar cell carcinoma.

Q. Do you recall the question being what was the relative risk reported in those studies of smoking and bronchoalveolar --

A. For that particular form of cancer there have been a number of studies that have reported different numbers.

Q. I'm asking about these studies, Doctor, in these studies what relative risks are reported for bronchoalveolar cell cancer?

A. Approximately one.

Q. Thank you.

Now, what percentage of lung cancer are bronchoalveolar?

A. It depends on which particular set of data that you look at. If you look at any data prior to 1960, none. It wasn't recognized as a histological type until the Liebow study in 1960. It takes a little while for us pathologists to get the word. And as a consequence, the specific pattern that Liebow describes, which by the way originally goes back to literature that goes back to the 1800s, but it was not recognized until that time. And as a matter of fact, there is a lot of smoking attributable lung cancer that was published prior to that time.

In any case, if one looks at the data that came out of many studies in the '70's and early '80's, one looks at around a factor of approximately 20 percent. And if one looks at some more recent studies, you can find as many as 40 percent of the cancers are classified as bronchoalveolar cell carcinoma.

Q. And you've cited studies by Dr. Auerbach and Garfinkel that also addresses this issue.

A. It also addresses that issue, yes, sir.

Q. So you would find in that article a reference to the 20 to 40 percent, correct?

A. I think you will find the most recent reference is the 1996 reference with Barkley and Green, and I know that they cite Auerbach study. And you will find a synopsis of the range of numbers that are found in that discussion, and that there appears to be a change in the incidence of that particular histologic type, which by the way you can't code an ICD-9. So if you use ICD-9 coding, and if we have a diagnosis of cancer, of lung cancer that hasn't any relationship to smoking, we can't code that.

Q. That was going to be precisely my point. We are going to get to in a few minutes, but you are jumping ahead.

It is certainly not your testimony, would it be, that the types of lung cancers that are associated with smoking in the sense of heightened relative risks, as you've defined them, --

A. Yes.

Q. -- are not found only in smokers, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: Those histologic types can be found in non-smokers, yes.

Q. (By Mr. Withey) All right. Confine yourself to the type of lung cancers that are associated with smokers in

the way you defined it, Doctor? Would you agree that the majority of smokers diagnosed with those types of lung cancers would not have developed their disease but for smoking?

A. No, I wouldn't agree with that statement.

MR. WITHEY: Would you mark this for me?

(Thereupon, Exhibit Number 2 was marked for identification, a copy which is attached hereto.)

Q. (By Mr. Withey) Doctor, I'm going to hand you what has been marked as Exhibit 2 to this deposition. It is table six and table seven from the 1989 Surgeon General's report. It sets forth the estimated relative risks for current and former smokers, both males and females, and I want you to review this table to see if you are familiar with it, and then I'll have some questions on it, okay.

And just to direct you, I'm going to specifically ask you about the line dealing with lung cancer in both of those tables.

A. All right.

Q. Now, in this particular table were separate relative risks estimated for each of the types of lung cancers that you list in your report?

A. No.

Q. Was the relative risk of lung cancer -- well, what is, for the record, what is the relative risk of lung cancer

ICD-9, 162 in male current smokers reports in this report?

A. There is a line that reads lung cancer (162), and under current smokers it says, it says that the title is relative risks. So presumably that's what the reference is to. It is 22.36, and I'm reading from the one that refers to males.

Q. Thank you.

A. Thirty-five years or more, four year follow up and for among the former smokers 9.36.

Q. Did you understand that these relative risks were derived from the C.P.S. II, or the Cancer Prevention Study II?

A. I have no idea what that particular study is. I have no idea what this 162 represents, whether that is a code that was used or that's some sort of a code that relates to ICD-9 or what it is.

Q. Do you ever use ICD-9 codes?

A. Yes.

Q. Do you know that 162 is the code for lung cancer?

A. 162 may be the category that includes lung cancer.

Q. Okay. Let's assume that it is, and therefore, the Surgeon General in fact used 162 to represent the ICD-9 code.

A. Okay.

Q. And so the relative risks of males 35 and over for

smoking and lung cancer is 22.36, correct?

A. In this one particular study apparently so.

MR. REILLY: I object to the form of the question.

Q. (By Mr. Withey) And do you know how large the study was by the way?

A. They refer to 1,491,791 man years of exposure. I have no idea what the total number of deaths were. That's not stated, number one. I have no idea which is the range of places where the data was collected from. None of that is clear.

Q. Well, because you haven't looked it up, right?

A. No.

Q. Okay. Now, suppose you were to group the types of lung cancer that you've listed into two categories. Those that you say are not associated with smoking and bronchoalveolar cell carcinoma and those that you say are associated with smoking, okay?

A. Uh-huh.

Q. You have to answer audibly.

A. Yes.

Q. Now suppose we are, just for the sake of this question, to use the Surgeon General's reported data to estimate two lung cancer relative risks in relationship to smoking, one for each of those two categories, do you understand?

A. Yes.

Q. And let's just use male smokers, okay. Would the relative risks for the category of lung cancer you say are not associated with smoking to come out around one?

A. Yes.

Q. And then the relative risks for the category of lung cancer you say are associated with smoking would have come out higher than the relative risk values in the Surgeon General's report, correct?

A. That would be a reasonable impression.

Q. Thank you.

A. The problem is we end up with absolutely ludicrous numbers.

Because that would indicate, using your logic, that would indicate a ratio of at least 30 to 1, which would indicate that almost certainly every one who dies of lung cancer of the category of any histologic type other than bronchoalveolar cell carcinoma would have to be a smoker, and we know that's patently untrue. So obviously something is wrong with the data.

Q. Move to strike as nonresponsive.

MR. REILLY: Wait a second. You know what, we'll remain in this, continue this deposition as long as everybody remains professional and appropriate. If that ceases to be the case, this deposition will end today.

Q. (By Mr. Withey) In the Surgeon General's citation to this study the lung cancers that aren't associated with smoking were mixed in with the ones that you believe are not associated with smoking under the heading 162 lung cancer, correct?

MR. REILLY: You know what, let's take a break.

THE WITNESS: I believe so.

Q. (By Mr. Withey) I want an answer before we take a break.

A. I believe so.

MR. REILLY: Let's take a break.

(Thereupon, there was a brief recess.)

Q. (By Mr. Withey) Going back to an answer you gave a while ago that you didn't know of any study that showed relative risks of smoking and lung cancer approaching 20.

A. Yeah.

Q. Do you now understand that at least there was this study that showed relative risks of above 20 for males above 35?

A. Let me just qualify my answer associated with that. At the bottom of this page it says source unpublished tabulations of the American Cancer Society. I don't think that you will be able to find a reputable refereed journal that would allow this sort of stuff to be published, and that's the reason it has never been published before. And

so it only finds its way in a setting where there is an advocacy preposition. I don't think this data is probably worth the paper it is written on.

Q. Don't hand me that document back because I'm going to ask you some other questions on it.

Fair enough?

A. Fine.

Q. So for instance, if we found the 20 relative risks in DeVita, you would say that's not worth the paper it is written on, would you?

A. In a paper by DeVita in cancer, in a paper by DeVita in oncology or in a paper by DeVita in a number of other sources or in something that is DeVita's unpublished notes.

Q. One that you have cited in your materials.

MR. REILLY: Object to the form.

Q. (By Mr. Withey) Would you find that reliable?

A. If you can find it in DeVita's text, that that represents what is a generally accepted notion for this category, I would regard that as a reliable example of somebody who believes that that's a number.

Q. And you thus stand corrected, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: If one could find an example in DeVita's text that says that, yes. If you can point

that out to me, then I would say, yes, that is an example.

Q. (By Mr. Withey) I'll save it for trial.

MR. REILLY: Object to the statement of counsel.

MR. WITHEY: I'm just letting him know.

MR. REILLY: Whatever it is, that's not what depositions are for.

MR. JOHNSON: I move to strike.

MR. WITHEY: You are going to move to strike it?

MR. JOHNSON: Your comment, yes.

MR. WITHEY: Then I won't save it for trial.

Q. (By Mr. Withey) Let's look at page 170 of DeVita, the article entitled the Epidemiology of Cancer by Joseph Framany. I'm going to read it. See if you agree with this statement. You understand Dr. Framany was one of four authors of the chapter on Epidemiology of Cancer found in the DeVita text that you've cited?

A. Yes.

Q. And it was on the same paragraph that I've already asked you whether you agree with or not, and you said you didn't as to smoking causing various cancers.

Let me read you the text of it. In the United States it appears that smoking, especially cigarettes, accounts for about 40 percent of all cancer deaths in man and about 20 percent in women with lung cancer representing

the largest proportion; do you agree with that?

A. No.

MR. REILLY: Object to the form of the question.

Q. (By Mr. Withey) Quote, "For smokers of two or more packs of cigarettes -- strike it. "For smokers of two or more packs per day, the risk of lung cancer is about 20 times that of non-smokers, and is much greater for the squamous and small cell carcinoma than adno carcinoma", do you agree with that?

A. What do you mean by do I agree with it?

Q. Do you agree for smokers who smoke two or more packs of cigarette a day the risk of non-smokers versus smokers is 20 times that of non-smokers?

A. I believe that there is a study that produced that result.

Q. Do you know if that conclusion by doctors -- do you have any basis as a pathologist for contesting the statement made by doctors Framany, DeVita, Hoover and Kinlen, K-i-n-l-e-n, the authors of Chapter 9, Epidemiology of Cancer in DeVita, that for smokers of two or more packs of cigarette a day the risk of lung cancer is about 20 times that of non-smokers?

A. I believe that there was a study that was done that produced that result.

Q. Do you have any basis based on your background and

training to disagree with the conclusions of these four epidemiologists that the relative risk of smokers who smoke two or more packs a day is 20 times that of non-smokers?

MR. REILLY: Same objection.

THE WITNESS: The mere statement that this occurs under these particular conditions -- I'm not contesting that some study was done. Do I believe that that's the true relative risk? No, I don't.

Q. (By Mr. Withey) And you don't think that the fact that people who smoke two or more packs of cigarettes a day have an increased risk of lung cancer that's 20 times that of non-smokers has anything to do with the fact they smoke, correct?

MR. REILLY: I object to the form of the question.

THE WITNESS: I've never said that.

Q. (By Mr. Withey) I'm asking you, is that correct?

A. Is it correct that it doesn't have anything to do? I've never said that it didn't have anything to do.

Q. Does it have -- the fact that --

A. It may have something to do.

Q. Does the fact that smokers of two or more packs of cigarettes a day has an increased risk of lung cancer 20 times that of non-smokers have something to do with the fact that they smoke?

MR. REILLY: Object to the form of the question.

Q. (By Mr. Withey) If you can answer that, please.

A. I think that anybody who smokes two or more packs of cigarettes a day smokes, yes, I agree with that statement.

Q. All right. Now you want to answer my question which was the fact that they smoked two or more packs of cigarettes a day and have a 20 times risk of developing lung cancer than people who don't smoke have something to do with the fact that they smoke?

A. I don't believe that 20 --

MR. REILLY: Hold on one second. Object to the form of the question.

THE WITNESS: That has something to do with the way somebody collected statistics. That doesn't have anything to do -- I don't think it has to anything to do with quote "their smoking".

Q. (By Mr. Withey) Statistical anomaly, correct?

A. No, I didn't say that. I said 20 is a bizarre number.

Q. So your testimony is there is something wrong with the statistics, and it has nothing to do with --

A. I don't know what the qualifications are.

Q. You have to let me finish the question.

A. Sorry.

Q. It is your considered judgment that the conclusion

that Doctors Framany and others have reached that the relative risk of smoking two packs of cigarettes a day is 20 times that of people who don't smoke is based on some problem with the statistics as opposed to the fact that it is because the people smoking get more lung cancer than the people who don't smoke; is that correct?

MR. REILLY: I object to the form of the question.

THE WITNESS: I believe a reputable study that is done looking at individuals who have two packs a day smoking history for some period of time will have a relative risk. And if that stays repeated multiple times, it will not end up with a figure of 20, number one. Number two, the fact that it ends up with any number doesn't necessarily indicate that the relationship is a causal relationship.

Q. (By Mr. Withey) I'm just asking you what do you think it accounts for, the 22 relative risks found in the Surgeon General's report Exhibit 2 I showed you, and the 20 times relative risk found that Doctors Framany and others state in their paper?

A. Bad study design.

Q. Okay. And what was wrong with the study design?

A. I don't know. I don't have the text of it in either case. This is an unpublished study. I don't know. I have no idea exactly how these statistics were obtained.

There is no methodology that is associated with this whatsoever. This is just stuff that got stuck in the report because it agrees with some advocacy position. This is a statement that is not apparently supported by a single record.

Is there a footnote associated with that statement?

Q. No.

A. It is some stuff taken out of context and put into the text. Okay.

You know, give me the study, and we'll look at it. And I will give you the criticism of the particular methodologic detail.

This is not a typical risk ratio that most smoking studies produce.

Q. When I asked you earlier you said bad study design. Let me just try to understand. You said there is a bad study design, but you don't know what the study design was as used by the Surgeon General, correct?

A. Correct.

Q. You are willing to criticize the design of the study --

A. Yes.

Q. -- even though you don't know what the design of the study was?

A. Absolutely.

Q. And you don't know how many people were in that study, correct?

A. Absolutely.

Q. And you don't care if it was the largest epidemiological study ever conducted, it doesn't matter, correct?

A. Absolutely.

Q. Because you know it could have never been 20 times the relative risk in any properly done study, correct?

A. Correct.

Q. And you've done such a study, correct?

A. There are multiple studies that have been done that have been published that come up with completely different results, number one.

Number two, like I have said in this particular case --

MR. REILLY: When you say this particular case and point to a document, that doesn't get on the record.

THE WITNESS: I'm pointing to this table.

MR. REILLY: State the exhibit number on it.

THE WITNESS: It has this Exhibit Number 2.

Q. (By Mr. Withey) What was the process by which this report was written, do you know?

A. I don't know.

MR. REILLY: You are referring to Exhibit 2?

Q. (By Mr. Withey) Yes. Well, the Surgeon General's report.

A. You said this was from the '89 report?

Q. Yes.

A. I think that report is a summary report is my recollection, or a review report.

Q. I asked you what the process was by which it was written.

MR. REILLY: I object to the form of the question.

THE WITNESS: I'm assuming the way most reviews are written.

Q. (By Mr. Withey) I'm asking you if you know.

A. Well --

Q. I'm not asking you to assume anything.

A. Well, I thought that I answered the question.

Q. What was the process, if you know, not what you assume. If you know what was the process by which the 1989 Surgeon General's report was rendered.

A. I believe it was a review.

Q. Does the fact it was a review mean that it was subject to -- well, do you know who wrote this chapter?

A. No.

Q. Do you know the qualifications of the person who wrote this chapter?

A. No.

Q. Do you know how many other people participated in the writing of this chapter?

A. No.

Q. Do you know how many people were shown the results of the study that were utilized in a peer review fashion to review the results?

MR. REILLY: I object to the form.

THE WITNESS: I don't know that there was a peer review.

Q. (By Mr. Withey) And you don't know that there wasn't a peer review, correct?

A. No.

Q. And do you know the qualifications -- did you understand this was a consensus report?

A. I don't know what the consensus means.

Q. Well, that generally means that anybody who reviewed this agreed with the conclusions and with the data.

MR. REILLY: Object to the form.

THE WITNESS: And if we elected presidents by consensus among democrats, we'd always have a democratic president.

Q. (By Mr. Withey) So do you think this is a political process?

A. It is a largely political process.

Q. And none of the people that helped prepare this report had any scientific training or background?

A. I didn't say that.

Q. What scientific training or background did they have?

MR. REILLY: Wait a second. The question is vague and ambiguous. I object to the form of the question.

THE WITNESS: I don't know.

Q. (By Mr. Withey) Now are you familiar with the epidemiological study of asbestos and smoking generally?

A. Generally.

Q. And you understand that a combined exposure of both cigarette smoking and asbestos is far larger than the increased relative risks of either exposure of the lung, correct?

A. That's a frequent finding, yes.

Q. Otherwise I think you referred one part of your report to synergistic or multiplicative effects; is that correct?

A. Correct.

Q. And do you believe there are synergistic interactions between smoking and asbestos to increase the relative risk from both of them greater than the relative risk of each of them?

A. I believe there is.

Q. Let me ask you to assume hypothetically, and then I'll mark this as Exhibit 3, that the relative risk for lung cancer in smoking without asbestos is 20, with asbestos -- strike that -- and the relative risk for asbestos exposure in lung cancer is five in non-smokers. And I ask you to further assume that the relative risk of both smoking and asbestos exposure is 100. Okay. Do you understand the hypothetical?

A. Yes.

MR. WITHEY: Let me have this marked.

(Thereupon, Exhibit Number 3 was marked for identification, a copy which is attached hereto.)

Q. Handing you what has been marked as Exhibit 3. Does this handwriting correctly state the hypothetical that I just asked you to assume?

A. Except it doesn't say it is a hypothetical.

Q. Do you want me to put hypothetical on it?

A. Yes.

Q. All right.

Okay. For the purpose of this hypothetical I'm asking you not to quarrel with the quantitative relative risks because I'm going to ask you some of the dynamics of the synergistic effects, okay?

A. Fine.

Q. I've added the term hypothetical with counsel's approval because of the witness' qualifications on the top of Exhibit 3.

Now, assuming these facts to be true as stated in this hypothetical, are persons who are exposed to asbestos at a greater risk of developing lung cancer if they smoke than if they don't smoke?

A. This would indicate they are.

Q. And in this example how does the lung cancer rate among smoking asbestos worker compare to the rate of non-smoking asbestos workers?

A. It is significantly higher.

Q. Would you agree that in this hypothetical study population the majority of smokers exposed to asbestos would probably not have developed lung cancer but for smoking?

MR. REILLY: You don't mind if I have a continuing objection to this hypothetical?

MR. WITHEY: Sure.

THE WITNESS: Yes.

And by the same token if they hadn't been exposed to asbestos --

Q. (By Mr. Withey) That was my next question.

A. Okay.

Q. Meaning if they had not been exposed -- well, I think it is clear.

A. To asbestos they also wouldn't have gotten lung cancer.

Q. Okay.

And would you agree therefore in this hypothetical study situation that the difference in lung cancer rates between smoking and non-smoking asbestos workers is due to smoking.

MR. REILLY: Object to the form.

Q. (By Mr. Withey) The difference between -- let me state that to make sure you understand.

The difference between the lung cancer rates between smoking and non-smoking asbestos workers is due to smoking.

A. No, I don't agree.

Q. If the smoking asbestos workers had not smoked, what would their relative risks have been?

A. I don't really have any idea because what happens is there is a lot of things that go together with smoking. And if they hadn't smoked, I don't know what else would have changed besides their smoking. The idea that somehow or another this allows one to isolate simply the smoking and we can forget about any other thing that happens to differentiate smokers from non-smokers, I'm not willing to accept that thesis.

Q. Is the difference in lung cancer rates between

smoking and non-smoking asbestos workers due in part to smoking if not totally?

A. It could be. As far as I'm concerned there is a possibility, there is a significant possibility.

Q. Okay. Now, I've asked you a hypothetical about lung cancer, smoking and asbestos, but I want you to assume I would ask you a similar hypothetical using two risk factors for C.O.P.D. and heart disease. I assume to save time your answers would be the same in a multiplicative situation -- go ahead.

MR. REILLY: Let me object to the form of the question.

Q. (By Mr. Withey) Let me withdraw the question.

I could ask you a whole series of questions about overweight and smoking in terms of heart disease, or exposure to toxic or fumes and smoking in relationship to chronic obstructive pulmonary disease, but rather than ask you all those series of questions, in a similar hypothetical would your answers be the same?

A. My answers would be the contribution associated with smoking does not allow it to be identified as a causal factor, yes.

Q. Well, then I'm going to ask the questions because I asked you more than that question. I understand that's your opinion, but I asked you a series of questions, so

let's go through them.

Let's assume we are talking about the hypothetical relative risks of coronary heart disease and comparisons of smoking and overweight. Okay. And I want you to assume that for people who smoke but are not overweight that the relative risks of developing coronary heart disease is a three. Also assume that for people who are overweight but don't smoke the relative risk of developing coronary heart disease is three. And obviously then I want you to further assume that if you smoke and are overweight, the relative risk of developing coronary heart disease are nine, okay.

(Thereupon, Exhibit Number 4 was marked for identification, a copy which is attached hereto.)

Handing you what has been marked as Exhibit 4. Does this correctly state the hypothetical I just gave you?

MR. REILLY: Object to the form of the question.

THE WITNESS: Yes, it does.

Q. (By Mr. Withey) Now, on that situation would you agree that again, this is a hypothetical, but in the study population in this hypothetical the majority of smokers that are overweight would probably not have developed chronic heart disease but for smoking.

MR. REILLY: Object to the form of the question.

THE WITNESS: In this hypothetical example they

would have been classified otherwise. So in other words, I compare it with what these figures are. But if you are saying that you attribute because of the fact that they could switch from one group to the other group if they didn't smoke, then I'm not willing to accept that hypothesis.

Q. (By Mr. Withey) Well, if you are not willing to accept that hypothesis, then I suppose I can't ask you any questions about it, right?

MR. REILLY: I object to the form of the question.

Q. (By Mr. Withey) I assume your answer would be the same no matter what question I ask you about this hypothetical, correct?

MR. REILLY: I object to the form of the question.

THE WITNESS: What I don't know is what isolates with, what confounds, what is associated with, what interacts with all of the various factors associated with smoking besides the actual smoking itself. And whether or not the differences that one sees with respect to relative risks are attributable to the smoking or attributable to one of the other factors that is not specified here.

Q. (By Mr. Withey) Well, let me go back to Exhibit --

A. I mean, you are assuming that there is only two factors in this hypothetical world, and If I can say --

Q. No, I'm not.
A. You are not?
Q. No.
A. Well, in that particular case let me add to the hypothesis that these represent guinea pigs rather than humans, in that particular case I would be willing to agree.
Q. No, I don't want to do that. You understand that even though Exhibit 3 was a hypothetical that there are in fact studies such as those done by Dr. Haman (phonetic) that show relative risks of smoking and asbestos exposure, correct?
A. Yes.
MR. REILLY: Object to the form of question.
Q. (By Mr. Withey) And those studies report out those relative risks, whether you agree that there are 20 in a hundred or five, I don't really care, but you understand there are relative risks?
A. I do.
Q. In other words, a chart that is somewhat similar to Exhibit 3 is found within those studies.
A. That's correct.
Q. And you understand that people such as Dr. Haman have concluded that both asbestos and smoking cause lung cancer, correct?
MR. REILLY: Object to the form of the question.

THE WITNESS: I'm not certain of that. I know that there are a number of people who have and who may be one of them.

Q. (By Mr. Withey) What medical societies are you a member of?

A. I'm a member of Dade County Medical Society, and the Florida Medical Society, and the Florida Society of Pathologists, and the College of American Pathologists and the American Association of Clinical Pathologists.

Q. Have all of those societies taken the position that smoking causes disease?

A. I'm not aware that any of those societies have taken that position.

Q. Are you a member of the American Medical Society Association?

A. No, I'm not.

Q. Are you aware that that association has taken the position that smoking causes disease?

A. Maybe. I'm not aware of that.

Q. Are you a member of any society that has taken the position, as you have, that smoking doesn't cause any diseases?

A. As far as I know, none.

Q. Do any societies that you belong to strongly encourage the physicians who are members of their societies

to advise their patients to quit smoking?

A. None of the societies that I belong to as far as I'm aware have an advocacy position in that.

Q. Do any of the societies that you belong to have a newsletter or publication?

A. They all do.

Q. Do you read them?

A. Yes.

Q. You get them in your office?

A. Mostly.

Q. How many years have you been reading the publications of the societies you've been involved with, since you've belonged?

A. Yes.

Q. Now, would you agree that in Exhibit 3, again, that smoking asbestos hypothetical, that in this hypothetical study population, hypothetical in the sense that we don't quote specifically from Haman's study, but in this hypothetical the incidence in this case of lung cancer is higher in smokers than it would have been in the absence of smoking?

MR. REILLY: Object to the form of the question.

THE WITNESS: Yes, the study demonstrates that, yes.

Q. (By Mr. Withey) Now in the second full paragraph

of the last page of your report if you can have that in front of you.

A. Yes.

Q. You state that attributing a percentage of a disease to any risk factor is fundamentally and scientifically a flawed concept, correct?

A. That's correct.

Q. Now, are you referring to the particular instance of a disease in a particular person and attributing it to the disease to a cause in that sense?

A. That's part of it, yes.

Q. In other words, you seem to draw the distinction, as I see it that There are many risk factors for each of these diseases that are listed, and any one of which, or any combination including unknown risk factors can be involved in an individual patient; do you see that?

A. Yes.

Q. And that assuming it follows from that, that the fundamental nature of a risk factor is a statistical concept applied to populations with no direct application to the individual. That's what you've written, correct?

A. No, I don't think so.

Q. Let me read it.

A. I think what I've stated is broader than that.

Q. Well, did you not write The fundamental nature of

a risk factor is a statistical concept applied to populations with no direct application to the individual?

A. Correct, I said that.

Q. Okay. And you agree with that?

A. Correct.

But the next statement has to do with population, not individuals.

Q. So you are testifying that it is impossible to quantify what portion of cancer, C.O.P.D. or cardiovascular disease might be associated with any one risk factor in a population?

A. Absolutely.

Q. And are you aware of any epidemiological texts that in fact do exactly that?

A. Yes.

Q. Okay. In fact, I can cite it to you, but would you agree that in DeVita there is reference to the population of attributable risks?

A. There are a lot of studies that deal with the concept of population attributable risks, and my thesis is it is a fundamentally flawed concept.

Q. And this is something you haven't written in the peer review literature, however, correct?

A. No, I haven't, but it is common sense.

Q. Okay.

Are you saying that the proportion of the disease in a population that is attributable to a particular risk factor is not the same as the proportion that would be avoided by removing the risk factor?

A. Absolutely.

Q. Are you saying it is less?

A. I'm saying it is generally an overstatement.

Q. No, I'm asking you whether --

A. The relative risk or the population attributable fraction is almost certainly in almost all cases an overstatement.

Q. Well, are you saying it is less or --

A. In those cases where it happens to be true, pardon --

Q. I'm just trying to understand the difference between just saying a proportion of disease attributable to a risk factor is different than the risk factor, the relative risk itself, do you understand what I'm asking you?

A. Those are directly derivable mathematical concepts. I don't understand. One comes from the other, so I'm not exactly certain what the argument is here.

Q. That's what I thought, and maybe we do have a misunderstanding.

Let's assume that a particular risk factor has a relative risk of three.

A. Fine.

Q. Exposure to the risk factor, relative risk of developing that end point disease is three times in the exposed versus the non-exposed.

A. Okay.

Q. Is it your testimony that it is improper to say that this relative risk of three is not attributable to the risk factor?

A. Absolutely.

Q. Okay.

And you are saying that even if a given proportion of a disease in a population would be avoided by removing that risk factor, in other words, that avoidable portion you are saying is not attributable to the risk factor, correct?

A. One can't follow from the other. There is no way of inferring from one what the other is.

Q. Define attributable.

A. Attributable is what statisticians decide to define attributable, and they've done that with respect to the risk ratios, And so what happens is, they say the population attributable risk, that's the percentage of the population that have some particular factor, and therefore, we are going to say that percentage represents the population attributable risk for that particular factor. And the problem, the fundamentally flawed part of that is if

you take and do that with every risk factor, you end up with three, four, 500 percent. How can one have 500 percent causation?

Q. Because as we've proven in asbestos and smoking, more than one risk factor may contribute to the disease.

A. Therefore how do we subtract out the part that is associated with smoking? What is the part that is attributable with smoking?

Q. The relative --

A. It has nothing to do with it.

Q. The relative risk of smoking in the absence of asbestos is the portion attributable to smoking, certainly not the whole amount. Statisticians and epidemiologists would not attribute in this hypothetical 300 to smoking would they?

A. No.

Q. They would attribute 20 in this hypothetical.

A. First of all, you don't use that statistic in population attributable risks. Find me a study that does that. They don't do that.

Because what happens is, the simple statistics that are associated with that don't allow for interaction. They assume linear interfere of the variant. And that's not what happened in this case.

Q. You are actually making my argument. Is it your

testimony that the epidemiologists and statisticians that use population attributable risks don't look at the relative risk?

A. They do.

Q. And what else?

A. They derive their population attributable fractions from the relative risk. Like I said, it is a mathematically derivable concept.

Q. What is the other factor in the population attributable risk formula, do you know it?

A. Well, the only -- it depends on whether or not you are referring to a case study or a cohort study. Basically the other factor is the people who presumably don't have the risk factor or what the background or what the natural incidence of the disease is, okay.

Q. Do you understand the population attributable risk is a mathematical formula?

A. I do.

Q. What is the formula?

A. It is equal to the relative risk minus one divided by the relative risk.

Q. You understand that there is a factor in this formula for prevalence?

A. What do you think the relative risk comes from?

Q. Prevalence is --

A. No, relative risk comes from prevalence.

Q. Okay. Do you understand prevalence is a different concept than relative risk?

A. I understand the prevalence of the disease in the population who doesn't have the risk factor relative to the prevalence of the disease that does have the risk factor makes the relative risk. That's the definition of relative risk. I'm sorry.

Q. Do you understand the concept of relative exposure, how many people smoke, how many people exposed to asbestos, how many people exposed to an environmental condition, do you understand that?

A. I understand prevalence.

MR. REILLY: Objection to the form.

Q. (By Mr. Withey) But that prevalence is not part of the population attributable risk formula, correct, that you've stated?

A. Well, it is, and I just gave you the derivation.

Q. When you use prevalence, you use prevalence of disease. I'm referring to it in a different concept. I'm referring to it as prevalence of exposure.

A. Prevalence of exposure, by exposure presumably you mean with respect to a factor; is that correct?

Q. When you define --

A. Yes, a variant, whatever it is you are talking

about.

Q. Correct, not disease?

A. Okay.

Q. That's the incidence, okay. The question is --

A. Prevalence is also -- there is also prevalence of disease and as a matter of fact, you need to have that factor. You need to know both.

Q. Okay. When you defined the population attributable risk formula, you remember you gave the answer a little while ago, you gave the formula?

A. That's one formula for it, yes.

Q. In the formula you gave you do not factor in the prevalence of exposure, correct?

A. I do.

Q. Okay. Well the record will be clear on that.

Now, the epidemiologist, and statistician and public health official that uses the concept of attributable risk, as I understand it that's a concept that you do not agree with the use of, fair enough?

A. I don't have any argument with using that as a statistic. I have a major problem with interpreting that as saying, oh, this is the amount that is caused by that, okay. This is a quantitation of causation because of this particular factor. That I have major, major objections to.

Q. Well, rather than --

A. Because it is phony.

Q. Going back to the statement you gave that one of the reasons the population attributable risk is phony, to use your expression, is because the total amount of disease attributable to particular risk factors, plural, may be more than 100 percent, correct?

A. Yes.

Q. And you have a problem with that, correct?

A. Major.

Q. And do you agree though that diseases, some diseases, are multifactorial?

A. I agree that most chronic diseases are multifactorial.

Q. Isn't one way of assessing the attributable portion of diseases that could be attributable to one factor, one risk factor, is to try to look at the data to determine what would be the relative risk absent that risk factor?

A. That may be an approach where you can collect data. And in fact, if you have -- if you have something to where you have a pure enough variant, it might be reasonable to make some sort of an inference. With respect to smoking it is definitely not the case.

Q. What is not the case?

A. You can't remove -- you can't just simply take

data and say, I'm going to create a smoking, a smoking attributable fraction, okay, to some particular disease using these simple population attributable fractions where you use smoking as the factor which separates smokers from non-smokers. So smoking is the variant. It doesn't work.

Q. Well doesn't --

A. I mean, you proved that it didn't work with your asbestos data. You proved it didn't work.

Q. What didn't work?

A. What you are assuming is that some how or another you can subtract out -- let me just give you this simple mind game. We are playing a mind game here.

Let's assume we didn't know anything about asbestos, okay, we didn't know anything about asbestos, and any sort of role it may have with smoking, all right. But that it happens to be something that we see as part of the overall picture. And then all of a sudden we discover, oh, asbestos is related. Then the question is, how much of it was due to smoking and how much of it was due to asbestos? Can't tell.

Q. Well, the question I'm having is if in this situation if you remove smoking, that is, if instead of having smoking asbestos workers, you looked at it and said well, if you removed smoking and you had only asbestos workers, there would be a decrease in the relative risk by

definition, correct?

A. That's right, but it certainly isn't a fraction. Here is part of the problem with the idea of a fraction. Presumably when we talk about a fraction, fractioning a population we can't have a possible population that is greater than one. We can't have more than 100 percent of the population. It is just not logical.

Q. Well, do you have death certificates where the cause of death is more than one?

A. I don't know what you mean.

Q. You list multiple causes of death.

A. Sure.

Q. So some people die of more than one thing, correct?

A. Yeah.

Q. And so in certain circumstances have you been able to determine, well, if it hadn't been for one thing, the person wouldn't have died?

A. Usually you can't make that kind of inference. Usually with the kind of interaction that occurs with variables, you can't make that kind of inference. Biology is never that simple.

Q. Well, have you ever done that in your experience as a pathologist? Do you ever list cause of death in your reports?

A. I don't. That's not my responsibility.

Q. Okay. Have you ever made any attempt to determine the cause of death in any patient?

A. No, not directly.

Q. Have you participated in efforts to determine the cause of death of a patient?

A. Yes.

Q. Have you ever attributed more than -- have you or the people you are working with ever attributed more than one cause of death to a particular person?

A. Probably in the majority of cases.

And ordinarily those factors are inextricably intertwined in a way where they can't be separated out.

Q. Sometimes they can be separated out, fair enough?

A. Probably so, yes.

Q. On page three of your report in the first full paragraph you list in addition to smoking a number of occupational exposures and other conditions you term risk factors for the development of primary lung cancer.

A. I apologize, which? Okay.

Q. I think it is --

A. Yes.

Q. Is it your opinion that a person exposed to any of those risk factors, take whatever one you want -- well, let's say any one of the risk factors or any combination of

the risk factors, is it your opinion that a person exposed to those risk factors does not increase his or her risk of lung cancer by smoking?

MR. REILLY: Could you read that back?

Q. (By Mr. Withey) Let me rephrase it.

In your opinion is it -- strike that.

Is it your opinion that a person exposed to any of those risk factors that you referred to or have in mind, or any combination of those risk factors, does not increase his or her risk of smoking -- strike that -- does not increase his or her risk of developing lung cancer by smoking?

A. Well, smoking is listed as one of the factors. I'm not exactly sure.

Q. So a person who is exposed to the other risk factors and exposed to smoking has a higher risk of developing lung cancer, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: We understand that there is synergisms in certain of these instances, okay. We don't know what the relationship is for most of these instances. And while it would be reasonable to assume that in at least some of the instances one might find synergistic effect that's only a reasonable assumption that has not been demonstrated as far as I'm aware with the exception of the case of asbestos.

Q. (By Mr. Withey) The question I have is whether a person exposed to any of those risk factors or combinations would increase his or her risk of lung cancer by starting to smoke?

A. What the data demonstrates is that smokers or people who smoke, and in addition to have one of these other risk factors, those individuals have a proportion or a relative risk higher than what ordinarily would be imputed by a simple sum of risks.

Q. In other words, if you are exposed to risk factors A, B, A, C and you don't smoke, you have a relative risk of lung cancer?

A. Correct.

Q. And if you have exposure to A, B, C risk factor, and you smoke, you'd have a relative risk higher than if you just had A, B and C.

A. That's correct.

Q. Okay.

So I take it then in your opinion that in populations of persons exposed to risk factors A, B and C, the rate of lung cancer are not the same for smokers and non-smokers, correct?

A. Probably not.

Q. Okay.

And would you agree that in such populations

people exposed to A, B and C risk factors and smoking that the incident of lung cancer is higher than it would have been in the absence of smoking?

A. Yes.

MR. REILLY: Object to the form of the question.

THE WITNESS: That's a reasonable inference, and I would make that.

Q. (By Mr. Withey) And yet because of the presence of these risk factors A, B and C you believe that the excess cases if you smoke are not caused by smoking, correct?

MR. REILLY: Object to the form of the question.

THE WITNESS: You know, it is like any other kind of interactive variable where the interaction is not a simple addition, and I don't know what those particular interactions are going to be in various cases.

The idea to attribute all of the increase to the smoking is absolutely as flawed as the concept of saying that all of the increase is due to the other factors.

Q. (By Mr. Withey) All right.

A. And that typically is what is done by the smoking data.

Q. Okay. What you would prefer is a system that attributes only a portion of the excess to smoking but not the entire excess to smoking, correct?

MR. REILLY: Object to the form.

THE WITNESS: The idea, the mere idea that this is a separable concept is a fundamentally flawed notion. It is the combination and only the combination that exerts the effect. And the idea that somehow or another you can infer what happens when you remove one or the other factor in a combination and attribute the difference because of the removal is a fundamentally flawed concept. That's what I'm trying to say.

Q. (By Mr. Withey) Well, the question I asked you was, your testimony is you can't attribute all of the excess cases or increased relative risk to smoking.

A. Or to the other variable.

Q. But the question I have is, can you attribute some of it to it?

A. You can contribute some of it to the interaction. It is a necessary part of the interaction. If you find this increases with the interaction, then it is absolutely an essential part of the interaction because it is an interaction.

Q. Well, I take it then --

A. But you can't push it out.

Q. But you can assess different relative risks for each risk factor, correct?

A. No, you can't.

Q. Isn't that what epidemiology does, assesses

relative risks for say smoking and asbestos?

A. They do. That's the sort of stuff that they do.

Q. And --

A. But what happens is when they do the study, they also have to take into consideration exposure. They have to take into consideration all the other variables. And as a matter of fact, they don't take into consideration most of the variables.

And in fact, if you actually look at their studies and you ask what part of the variants that they see in their studies is explainable by their study, most of it is not explained, and that's the whole point. We don't understand how it works. It certainly doesn't function together in a simple additive sense. We know that.

And we have all kinds of examples. The question is, do we understand the whole process at all? And the answer to that question if you look at statistician's data, the things they generate themselves, you have to come to the conclusion we don't understand fundamentally what is going on, and that's my argument.

Q. Are you done?

A. Yes, sir.

Q. Have you ever subject that argument to peer review?

A. That argument is repeated throughout the

literature in study after study, whether we are talking about cancer, we are talking about coronary heart disease or we are talking about anything, yes. I mean there is no reason for me to asperse that idea. It is a fundamental idea.

Q. I'll move to strike as nonresponsive.

The question asked is, have you ever subject that argument to peer review?

A. No.

MR. REILLY: Let's take a short break.

MR. WITHEY: We are almost done. If you need a break, go ahead.

MR. REILLY: I just wanted you to let him finish his question before you answer.

MR. WITHEY: If you want to take break, that's fine too.

MR. REILLY: No, it is okay.

Q. (By Mr. Withey) Do you understand that epidemiologists and statisticians working with them produce independent risk factors -- strike that.

Do you understand that epidemiologists and statisticians working with them report relative risks for a variety of risk factors in a particular disease?

A. Yes.

Q. And you understand that often they report these

risk factors separately in addition to the synergistic interaction?

A. Yes.

Q. And do you have an understanding that these same scientists assign a relative risk that might differ from one risk factor to the other?

A. Yes.

Q. And do you understand that there is a magnitude of a particular relative risk for one risk factor that might be greater than that for another risk factor?

A. Yes.

Q. All right. And do you understand that it takes judgment as an epidemiologist to determine whether something is a risk factor in the first place, fair enough?

A. Yes.

Q. And you've already defined risk factor, I think, for the purpose of this deposition, correct?

A. Yes.

Q. And using your definition of risk factor you would certainly understand that using your definition there are some relative risks that are higher for some risk factors than others, correct?

A. Yes.

Q. And that the magnitude of the relative risk shows that the higher a relative risk is, the greater number of

cases or incidents of the given end point disease is in the exposed population compared to the unexposed population, correct?

A. Yes, and that qualification, the terminable qualification, is an extraordinary critical part of that observation, yes.

Q. Okay. Now, given what you just testified to as something you agree with, do you also agree that it takes judgment as an epidemiologist to determine as between one risk factor and another risk factor what the relative magnitude of the increased risk coming from where a person or group of people, I should say, is exposed to multiple risk factors? Do you follow me?

A. Not exactly.

Q. Let me clarify the question I'm asking you.

If there is a person exposed to risk factor A and it has a relative risk of 1.5 and the same person exposed to risk factor B with a relative risk of 10 --

A. Uh-huh.

Q. -- would the epidemiologist not be able to use that person's judgment and experience to determine that in that case that the end point disease, that factor B, was a great contributor to the disease in the population than factor A?

MR. REILLY: Object to the form.

THE WITNESS: That would be a simplistic interpretation of the data which is very often implied because in those instances where factor C has a relative risk of 40 times than the others were then probably all the inferences between A or B are completely erroneous.

Q. (By Mr. Withey) Even if the population was not exposed to C?

A. Obviously in the case where I just added to your example they had to be involved because it is a relative risk of 40 rather than three or nine.

Q. You changed the question, but I wanted you to focus on the question that had one risk factor of a relative risk of 1.5, another risk factor has a relative risk of 10 and there is an absence of other risk factors in the development in this study, okay, such as --

A. In the study or in the process? And that's the fundamental difference.

Q. Well, in the study.

A. In the study I have no idea whether the study is isolating the appropriate factors or not.

Q. Assuming it does.

A. Assuming it does and assuming that these factors are in exclusion to all other factors, yes.

Q. Yes?

A. Yes.

Q. And such studies have been done, correct?
A. Pardon?
Q. Depending on what risk factor C is?
A. Or D, E, F, G, H, I, J, K, L, M, N.
Q. Such a risk factor may include ages, may include people who are not over 65, for instance?
A. Yeah.
Q. That might exclude risk factors by the design of the study.
A. Correct.
Q. People who do not drink any alcohol might be excluded within the study. That might be a risk factor C that you gave.
A. That's a possibility, yes.
Q. And the question is then do you believe that it is proper for epidemiologists to say, well, I have a risk factor for risk factor A and it has a risk of 1.5 and the risk factor B, and it is a relative risk of 10, and I find B in a number of cases, and I could determine the prevalence of that exposure to A and B in the general population that is under study. I'm going to attribute more of the incidence of disease to risk factor B than I am to risk factor A, not necessarily all of it, but more of it. Do you have any quarrel with that?
A. I may have.

MR. REILLY: Object to the form of the question.

THE WITNESS: Whenever one uses two risk factors and one attempts to separate out the relative contribution of the two risk factors, there are some standard statistical methods for doing that. One factor that is involved, as an example in your multiple regression analysis, is to say, how much do you think is unexplained in your data by something other than these two risk factors? If what is unexplained is a very small amount, then I think it is a reasonable inference. If in fact what is unexplained is most of the data, then I think it is a poor inference.

Q. (By Mr. Withey) Okay.

You state in that same paragraph that it is impossible to quantify what proportion of cancer, C.O.P.D. or cardiovascular disease might be associated with any one risk factor, correct?

A. That's correct.

Q. And are you saying that it is impossible to quantify the proportion of disease in a population that is associated with a given risk factor, are you speaking here of a proportion of a disease in a particular human being?

MR. REILLY: Object to form.

THE WITNESS: That basis is a population statement. Certainly it obviously applies to the

individual, I mean, but the statement itself has reference primarily through a population.

Q. (By Mr. Withey) So both in other words?

A. Yes.

Q. And how are risk factors identified?

A. Risk factors are identified using very simple studies to where you just take some particular variable, call the variable a risk factor and you look to see what the prevalence or the frequency of that particular factor is in a group with disease and without disease, or you can take two different groups with disease that have disease and look to see what the prevalence of the factor is in either of those studies. And if you end up with a -- if the factor ends up having being present in more instances with the disease, then you say there is a positive association or an increased relative risk. And if in fact the inverse is that particular factor is found less frequently in that case of disease, then you say it is a protective or whatever, or preventative factor.

Q. I'm trying to go back to the statement that it is impossible to quantify. Isn't relative risk at least an estimate of the quantification of the risk of the impact or the proportion of certain --

A. I had stated earlier that -- I'm sorry, did I interrupt your question?

Q. You did, but go ahead and answer it.

A. I had stated earlier that the relative risk with respect to proportioning disease ends up being a sort of upper bound of an estimate. The lower bound may be zero, but the upper bound is what the relative risk is. And so there invariably is an overstatement of the risk.

Q. Well, but it is quantifiable. The relative risk is quantifiable for a given risk factor, correct?

A. It is quantifiable in the sense that there is a number that comes out, okay, attributing that particular number to a particular population attributable fraction. This is where the flaw comes in, okay. There is no problem with risk ratios or relative risks. That's a number, and it comes out of a particular study with a defining population. And you are going to generate the number. You have a methodology, et cetera, and therefore it is a number, and therefore it is a quantity. Therefore you can say it is quantitative.

What I'm saying, when one attempts to attribute causation or when one attempts to impute what would have happened if we had removed this variable, okay, that as a number when one attempts to do that one produces an overestimate which may be anything from a small overestimate to a gross overestimate of the actual nature of the variable or the risk factor.

Q. Well, isn't it a relative risk derived from a study and statistical analysis of a group of people?

A. The relative risk for a particular factor or a combination of factors? What are we talking about because the two different studies produce different numbers.

Q. Sure. I'm talking about both.

A. Okay.

Q. In other words, a combination of risk factors and isolation of given risk factors which we've already talked about. The question is, aren't those numbers derived from a study of disease or death in a particular population?

A. They derive from that, yes.

Q. When you say that there are 20 risk factors, let's say of ten, for the presence of a given -- strike that.

When you say there is a relative risk of ten for the presence of a given risk factor, you are talking about ten times as many people in a given study had a given disease than those who did not have that risk factor in that study, correct?

A. That's correct.

Q. And so what I guess I don't understand in the nature of epidemiology, the epidemiologists and statisticians attribute a risk of a particular disease in a particular population, both with the presence of a risk factor and without the presence of a risk factor, correct?

A. Uh-huh.
Q. You have to answer audibly.
A. Yes.
Q. And that's the nature of epidemiology as a science, fair enough, at least in part, is to determine whether we have a population of people who have this disease, and we want to find out how many people did smoke and/or how many people are overweight and aren't overweight, or drank alcohol or didn't drink alcohol. That's part of what epidemiology does.
A. Yes, but mostly --
Q. You've answered the question.
MR. REILLY: Wait a second. If he has more --
THE WITNESS: When you say it is part of what they do, it is a minor part of what they do.
Q. (By Mr. Withey) You've answered it.
A. Okay.
Q. You believe there is such a thing as a causal risk factor?
A. A causal risk factor?
Q. Yes.
A. I don't know what you mean by that. Let's say if a risk factor is causal, doesn't that mean that if exposure to the risk factor could be prevented the incidence of the associated disease would be lower?

I believe there are such things, yes.

Q. Okay. And in that case isn't the relative risk in relationship to that risk factor a quantitative measure of its effect?

MR. REILLY: I object to the form of the question.

THE WITNESS: Are we talking about being a circumstance where there are multiple causative factors or a single causative factor?

Q. (By Mr. Withey) Well, I asked you previously that if a risk factor is causal, doesn't it mean that if exposure to the risk factor is prevented, the incident of the associated disease would be lower, could be lower in isolation with other risk factors or lower within the presence of risk factors B, C and D as well? Again, I'm asking you in either instance isn't it then in those circumstances the measure of relative risk a quantitative measure of the effect of having the presence of risk factor A whether it be independent or in conjunction with risk factor B, C and D?

A. The two studies are absolutely impossible to separate.

Q. All right.

A. The inference with respect to cause in no way influences what the numbers are. That comes out of the study. Can you produce the same sort of numbers with the

causative factor and a non-causative factor? Yes.

Q. Well, not always, correct?

A. Not always.

Q. Well, for instance, does old age cause lung cancer?

A. Yes.

Q. Okay. What else causes lung cancer?

A. I mentioned several other things if you'd like me to read my list again.

Q. You have. Never mind.

A. Okay.

And I think there are probably several other things that are not on that list.

Q. Okay. Do you understand the concept of biological plausibility?

A. The concept of biological plausibility?

Q. Yes, sir.

A. No, I don't understand the concept of biological plausibility.

Q. Are you familiar with the Sir Austen Hills criteria for inferring causation?

A. I believe I've read it.

Q. And do you know what the criteria are?

A. I believe he includes something like this idea of biological plausibility.

Q. Is smoking and lung cancer a biological plausibility?

A. To some people.

Q. Is it plausible to you?

Do you understand?

A. Yes.

Q. In other words, you understand that smoke gets in the lung and gets into the alveolar tissue, right?

A. Yes.

Q. You understand that studies have shown, the impact of smoking on such diseases as emphysema where the lung tissue is diseased, correct?

A. Yes.

Q. And you would agree that at least there is a plausible biological if not proven mechanism for that association, correct?

MR. REILLY: Object to the form of the question.

Q. (By Mr. Withey) That is, excuse me, smoking and emphysema.

A. Yes, I believe that there are people who would regard that there is a plausible relationship. The problem with plausibility is we've been so wrong so many times in medicine. And if you'd like for me to state several instances, I will be happy to do so.

Q. Wouldn't you agree that biological plausibility

should be considered with other factors to determine causation rather than be the one and only factor to look at?

MR. REILLY: Object to the form.

THE WITNESS: I regard biological plausibility as absolutely totally insufficient to make causation.

Q. (By Mr. Withey) I'll move to strike it as nonresponsive.

Would you look at biological plausibility in conjunction with other factors rather than looking at it in isolation in determining causation?

A. I'm not interested in biological plausibility.

Q. Have you read the Surgeon General's report of 1989 that looked to the issue of pathogenesis of particular diseases linked to smoking specifically C.O.P.D., lung cancer? Do you understand the Surgeon General's report in 1989 looked at the pathogenicity of smoking in those diseases?

A. I know there was a review of some data related to the pathogenicity.

Q. What does pathogenicity mean to you?

A. Patho means disease and gen means origin.

Q. Is etiology another word for the same thing?

A. No, it is not.

Q. What is the difference?

A. The difference is etiology is interpreted by most

physicians to represent a causal factor, okay, whereas pathogenicity represents the process, which it may well include causation, but it represents the process, the development of disease from the point of causation forward.

Q. Have you read the articles that are cited in the 1989 Surgeon General's report that addresses the issue of pathogenicity of smoke and various disease outcomes?

A. I've probably read some of them.

Q. Okay. And I assume you have not published in the issue of pathogenicity of any smoking diseases, correct?

A. I have not.

Q. Is carbon monoxide associated with heart disease? The inhalation of carbon monoxide, I should say, into the human lung associated with heart disease in humans?

A. There are a number of people who have purported to demonstrated some sort of relationship.

Q. Do you know -- do you understand if you breathe carbon dioxide you could die?

A. If you breathe enough of it I understand that. I also understand that the body manufactures carbon dioxide.

Q. I'm talking about carbon monoxide.

MR. REILLY: You said carbon dioxide.

Q. Are you familiar with the concept of carboxyhemoglobin?

A. Yes.

Q. You understand that the carbon monoxide binds to the hemoglobin, to the blood, to produce carboxyhemoglobin?

A. Yes.

Q. Have you ever tested the level of carboxyhemoglobin in human blood at autopsy or biopsy?

A. Yes.

Q. Are you familiar with the literature showing that smokers have generally on the average a higher incidence of carboxyhemoglobin than non-smokers?

A. I am.

Q. What do you think it is for if the presence of carboxyhemoglobin is higher in smokers compared to non-smokers?

A. Smoking.

Q. And what about smoking increases the carboxyhemoglobin level in a smoker's blood?

A. It says right on the cigarette package cigarette smoke contains carbon monoxide.

Q. So you agree with that then?

A. Oh, it is.

Q. And the fact it contains carbon monoxide, I assume by smoking a cigarette, carbon monoxide is thus either ingested or inhaled and entered into the blood stream?

A. Correct.

Q. And does that produce any adverse effects on the

human body, the ingestion or inhalation of carbon monoxide --

MR. REILLY: Object to the form.

Q. (By Mr. Withey) -- in your opinion.

A. In my opinion the average driver that drives down I-95 every morning ends up with a higher level of carbon monoxide in their bloods. The average urban dweller ends up with a higher level of carbon monoxide in their blood.

I think that most of the levels of carbon monoxide that one finds they have relatively little or no effect on the patient's health.

Q. What is the little effect that a smoker inhaling carbon monoxide has on the human cell tissue?

A. What is the little?

Q. You said little or no effect. What is the little effect?

A. The little effect is that if you have 10 percent carboxyhemoglobin in the blood, it lowers the oxygen carrying capacity of that particular fraction of the blood by whatever the saturation capacity is of the remaining fraction, so that may be as much as 90 percent of an arterial blood.

Q. Does that affect the blood in any way?

A. It can. If the patient has major cardiac failure or cardiac insufficiency, it will affect. Otherwise, it

doesn't.

Q. Does the ingestion of carbon monoxide by women that are pregnant go through the placenta barrier by way of the blood?

A. Yes, it would.

Q. Does that affect the birth weight of women who give birth to children who were in fetus when the mother smoked?

A. I don't think anybody has ever demonstrated that inference.

MR. REILLY: Object to the form of the question.

Q. (By Mr. Withey) Do you believe that carbon monoxide ingestion through cigarette smoke by pregnant women is not healthy --

MR. REILLY: Object to the form.

Q. (By Mr. Withey) -- for the fetus?

A. It is recommended that women who are pregnant not smoke, and I think that's probably a good recommendation.

Q. Why?

A. For the same reason why it is recommended that women not drink, for the same reason that it is recommended that women take additional iron in the diet, for the same reason it is recommended that they take additional folic acid in their diet, et cetera, et cetera, et cetera. We are very conservative in that respect to pregnancy and the

management of pregnancy. The decision is to do anything to remove anything that is a potential risk, whether it is an actual risk or not.

Q. Do you think ingestion of carbon monoxide is an actual risk to the fetus?

A. No, I don't think it is.

Q. What are the biochemical markers for the uptake of tobacco smoke, Doctor?

A. The biological factors for the --

Q. Markers.

A. Markers?

Q. Biochemical markers. Do you know what that term means?

A. I think so.

Q. Okay. What are the biochemical markers for the intake or uptake of tobacco smoke?

MR. REILLY: Object to the form of the question.

THE WITNESS: Does that mean the inhalation?

Q. (By Mr. Withey) Yes, by smoking.

A. There are -- the most common ones that are biochemical markers -- you mentioned carbon monoxide. The ones that have been mentioned more frequently, nicotine and cotinine.

Q. Any others?

Certainly carboxyhemoglobin.

A. I just mentioned that if you would go back and read my answer.

Q. I thought you said carbon monoxide.

A. Well, you asked what the marker is. Carboxyhemoglobin is not ingested.

Q. Well, but markers --

A. The marker is the carbon monoxide.

Q. All right, not the carboxyhemoglobin?

A. Correct.

Q. Can't carbon monoxide only be measured by exhaled air?

A. Can't it only be measured by pardon?

Q. Exhaled air from the lungs?

A. Carbon monoxide?

Q. Correct.

A. No.

Q. How else do you measure carbon monoxide?

A. Well, I think I can give you about ten different ways of measuring it.

Q. You gave me one. What are the others?

A. What are the others?

Q. Yes.

A. First of all, it is measurable in blood where most of it is bound to reduce hemoglobin. It can be measured by a variety of techniques in blood. It can be measured in

other tissues.

The way these things were measured to begin with was to take blood and to take human tissues and to release the gasses from the tissues and measure it in the gas phase. That's the way the first measurements were made.

Q. Then it got more refined and carboxyhemoglobin was measured in the blood?

A. It is easier to measure.

Q. Do you know of any other biochemical markers of cigarette smoking?

A. The three that I've mentioned are the most popular ones that come to mind.

Q. How does hydrogen cyanide interact in the human saliva, urine, serum?

A. Hydrogen cyanide binds to hemoglobin to form cyanmethemoglobin. It is an oxidation process that's involved.

MR. REILLY: It is about five to 1:00.

MR. WITHEY: I'm almost done.

Q. (By Mr. Withey) How is H.C.N., and again I'm using the term H.C.N. to refer to hydrogen cyanide. How is that absorbed in human body? How is it absorbed, through inhalation?

A. Yeah, it is a gas.

Q. Where does it go?

A. Wherever gas is. I mean, if we inhaled something, then it enters through the lungs.

Q. And gets in through the heart through the bloodstream?

A. It gets into the bloodstream and then the heart, yes.

Q. And do you know where its biochemical markers are found in the human body?

A. Where biochemical markers? I told you what the ordinary metabolism is of it, right. It binds to the hemoglobin to form cyanmethemoglobin. I'm not exactly sure what happens after that particular point, any additional metabolism of cyanide.

Q. Is it toxic?

A. It is what they use in the gas chamber.

Q. Is it toxic?

A. Pardon?

Q. Is it toxic?

A. For those people in the gas chamber it sure is.

Q. Does it require any body organ to detoxify the presence of H.C.N?

A. We ordinarily ingest a significant amount of H.C.N. in the daily diet. Yes, there is a metabolic pathway to get rid of it.

Q. What is it?

A. I don't know all the particular steps of intermediary metabolism for hydrogen cyanide.

Q. Must be the liver, right?

A. Probably. The liver is pretty crucial in the whole process, yes.

Q. That's all I have. Thank you, Doctor.

MR. REILLY: We'll read and sign.

Q. (By Mr. Withey) I'm sorry, one last question. Do you expect to do any additional work other than preparing and testifying in this case?

A. I have no expectations.

Q. And you have stated in your report and today in this deposition all of the opinions you have relative to this particular assignment, correct?

A. No, sir.

Q. Well, you know, we are entitled to know all your opinions. And I've read your report and it states a number of opinions. Do you have any supplement to your report that you expect?

A. I have no supplement to create to the report. Are there any other opinions other than those expressed? Yes, I have other opinions.

Q. About the topics that you have not included in your report -- strike that.

Do you have any other opinions that you have

presently that you have not put in your report related to the topics that are in your report?

A. I think that the report provides an adequate summarization of most of my important opinions, yes.

Q. Are there any other important opinions?

A. I'm not hiding any opinions, no.

Q. Well, I need to know if you have any other opinions on the categories that you've set forth in your report that are not --

A. No, no.

Q. Okay. Thank you.

(Thereupon, the deposition was concluded at 1:00 p.m.)

(Thereupon, the reading and signing of the deposition was not waived.)

_____

X Deponent.

CERTIFICATE OF OATH

I Teresita Miranda, the undersigned authority, certify that Dr. Christian D. Wunsch personally appeared before me and was duly sworn.

WITNESS MY HAND AND OFFICIAL SEAL

THIS 9TH DAY OF JULY, 1999.

Teresita Miranda

TERESITA MIRANDA,

NOTARY PUBLIC - STATE OF FLORIDA

TERESITA MIRANDA
MY COMMISSION # CC 775092
EXPIRES: October 18, 2002
Bonded Thru Notary Public Underwriters

CERTIFICATE

STATE OF FLORIDA)
)
COUNTY OF DADE)

I, Teresita Miranda, Registered Professional Reporter and Notary Public, certify that I was authorized to and did stenographically report the foregoing deposition; and that the foregoing transcript is a true record of the testimony given by the witness.

I further certify that I am not a relative, employee, attorney, or counsel of any of the parties nor am I a relative or employee of any of the parties' attorneys or counsel connected with the action, nor am I financially interested in the action.

DATED THIS 9TH DAY OF JULY, 1999.

Teresita Miranda

TERESITA MIRANDA,
REGISTERED PROFESSIONAL REPORTER AND NOTARY PUBLIC

Wunsch-1
EXHIBIT
DM 6-29-99

EXPERT DISCLOSURE

Northwest Laborers - Employers, et al. v. Philip Morris, Inc., et al.

Christian D. Wunsch, M.D., Ph.D.
Associate Professor
Department of Pathology
Jackson Memorial Hospital
1611 N.W. 12th Avenue
Miami, Florida 33136

Qualifications

Dr. Wunsch is board-certified in clinical pathology, practicing in the field for over 25 years. Dr. Wunsch obtained his medical degree, as well as his masters and doctorate degrees in biochemistry, at Northwestern University in Chicago, Illinois. He completed his internship and residency in clinical pathology at Peter Bent Brigham Hospital and a pathology fellowship at Harvard Medical School in Boston, Massachusetts. His attached curriculum vitae, includes his professional appointments and responsibilities, affiliations, and publications.

Dr. Wunsch is expected to testify at trial about: (1) the multiple risk factors associated with various cancers and other human diseases, (2) the potential for misdiagnosis of human cancers and diseases, (3) the mechanism of action for development of various cancers and other human diseases, and (4) the proportioning of disease etiology to associated risk factors.

Risk Factors for Human Diseases and Cancers

Diseases of the cardiovascular system, the respiratory system, and cancer in any given individual are multifactorial in nature. These risk factors are both known and unknown. Risk factors differ for each patient - each patient has a unique profile of risk factors for each different disease.

The diseases and cancers that have been associated with smoking have many other risk factors which commonly include age, sex, genetic predisposition, economic status, lifestyle behaviors, diet, alcohol consumption, and environmental or occupational exposures. Unless these as well as other unique risk factors for specific diseases and cancers are considered in a statistical model, any estimation of smoking-related medical costs is inaccurate. The statistical models that are typically applied to the understanding of risk factors are incapable of dealing with the large number of risk factors that are known to be important. As a consequence, the conclusions drawn from their application have a high degree of uncertainty.

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Misdiagnosis of Human Diseases and Cancers

Results of epidemiological studies may be misleading if the data on which they rely result from an incorrect diagnosis of disease and/or an inadequate assessment of the relevant risk factors. For example, epidemiological studies often rely on ICD-9 coding or death certificate diagnoses, either of which may be inaccurate. Even if epidemiological studies demonstrate a relationship between a risk factor and a disease, these studies do not prove medical causation because these studies are based on statistical data, and statistical data alone do not prove cause and effect.

ICD-9 codes are used primarily for medical reimbursement purposes. These codes are usually assigned by paid medical coders, not physicians, so that the choice of codes may reflect financial rather than diagnostic objectives. Additionally, the accuracy of these ICD-9 codes is rarely validated. The ICD-9 coding system itself does not allow for important diagnosis distinctions. For example, ICD-9 coding for primary cancer of the lung does not specify histological type. Therefore, ICD-9 codes are not appropriate disease diagnoses for epidemiological or statistical purposes.

Death certificate diagnoses may be inaccurate because they are not always based on pathology or accurate, factual and complete clinical data. The clinical diagnosis of a disease is often inaccurate, as demonstrated by autopsy results. Autopsies are rarely performed in hospitals today, and depending on the medical institution, the rate of clinical misdiagnosis of disease may vary.

Even with modern diagnostic methods and technologies, the probability of misdiagnosis is still significant. Clinical misdiagnosis of cancer, cardiovascular diseases and COPD may occur, and the reasons for misdiagnosis vary. Factors that influence clinical misdiagnosis of these diseases include the nature of disease processes, the accuracy and completeness of clinical data, the diagnostic techniques used, and the uniqueness and complexity of each individual patient's physical makeup and medical history. Examples would include metastatic lung cancer mistaken for primary lung cancer or pulmonary embolus mistaken for a heart attack. The combination of errors in disease diagnoses and ICD-9 coding results in inaccurate calculations of medical costs associated with specific diseases.

Lung Cancer

The lungs are a common site for metastatic cancer. Lung cancer generally has a poor prognosis, so that in cases of advanced cancer, tumor biopsy or differentiation between primary and metastatic disease may not be done. A distant occult primary may be present but not diagnosed if there is no autopsy. Also, differential diagnosis between primary and metastatic lung cancer may not always be possible.

The association between smoking and lung cancer is not the same for all types of lung cancer. Small cell and squamous cell carcinoma are associated with smoking, but bronchioloalveolar

cell and carcinoid carcinoma are not necessarily associated with smoking. Even with modern technology, diagnostic methods still have limitations in their accuracy, particularly if the pathology sample is obtained by bronchial washings or brushing or by needle biopsy.

There are multiple risk factors for the development of primary lung cancer. These risk factors include smoking, occupational exposures such as asbestos, radon, chromium, nickel, polyaromatic hydrocarbons, chloromethyl ether, and inorganic arsenic compounds, environmental exposures, prior lung scars or diseases, positive family history, and diet.

Other Types of Cancers

The development of cancer is a complex and multifactorial process. All types of cancers involve multiple factors in their development. For example, multiple distinctive risk factors have been identified for cancers of the larynx, mouth, esophagus, pancreas, kidney, bladder, and cervix.

Chronic Obstructive Pulmonary Disease (COPD)

Chronic obstructive pulmonary disease includes chronic bronchitis, emphysema, and aud asthma. Risk factors for COPD include cigarette smoking, air pollution, occupational exposures to inorganic or organic dusts, as well as noxious gases, indoor air pollution such as the use of natural gas or kerosene to heat or cook, and familial and genetic factors such as alpha-1-antitrypsin deficiency.

Cardiovascular Diseases

There are numerous known and unknown risk factors for cardiovascular diseases. Important known risk factors include genetic makeup, age, sex, hypertension, abnormal blood lipids, smoking, diabetes, diet, stress, inactivity, obesity, Type A personality, and elevated blood homocysteine levels.

Mechanism of Action for Development of Human Diseases and Cancers

Mechanisms by which it is claimed that smoking may result in various diseases or cancers have not been proven. For example, animal inhalation studies designed to investigate smoking and disease have not supported claims that smoking causes lung cancer, emphysema, or cardiovascular disease. Likewise, animal skin painting studies have not proven that smoking causes lung cancer. The failure of animal toxicology studies to consistently produce cancers suggests that other factors should be considered. As another example, genetic markers for cancer are not sensitive

or specific for smoking-related cancers. Cancers without specific mutations for certain tumor suppressor genes can occur in smokers, and cancers with these mutations can occur in nonsmokers.

Proportioning of Etiology for Human Diseases and Cancers

Cardiovascular disease, COPD, and cancer are complex processes. The specific origins and specific pathophysiologic mechanisms involved in the development of these diseases at a cellular or molecular level have not been established. Many risk factors may act synergistically to increase the risk of development of these diseases. Also, cardiovascular disease, cancer, and COPD can occur in the absence of any identifiable risk factors.

It is impossible to determine in a given patient which, if any, risk factors are involved in the development of cardiovascular disease, COPD, or cancer. There are many risk factors for each of these diseases, any one of which, or any combination including unknown risk factors, can be involved in an individual patient. The fundamental nature of a risk factor is a statistical concept applied to populations with no direct application to the individual. Furthermore, it is impossible to quantify what proportion of cancer, COPD, or cardiovascular disease might be associated with any one risk factor. Attributing a percentage of a disease to any risk factor is speculative in light of the incomplete state of medical knowledge and the uncertainty surrounding the attempted quantitation of the statistic itself. Further, attributing a percentage of a disease to a risk factor is fundamentally and scientifically a flawed concept.

Dr. Wunsch is expected to base his opinions on his education, skills, training, experience, research, and his review of the medical literature concerning the above subject matters. Dr. Wunsch may be asked to comment on the opinions expressed by other witnesses, as well as the evidence on which they may rely, to the extent that these opinions relate to his experience and expertise.

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2. Cancer: Principles & Practice of Oncology, 4th ed., edited by Vincent DeVita, Jr., Samuel Hellman, and Steven Rosenberg, J.B. Lippencott Co. (1993)

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2. Michael McFarlane, Alvan Feinstein, and Carolyn Wells, "Necropsy Evidence of Detection Bias in the Diagnosis of Lung Cancer," Arch Int Med 146: 1695-98 (1986)

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4. Paul Grimaldi, Julie Micheletti, and Madeline Zipkas, "The Use of DRGs - Selected Implications for Medical Record Department," JAMRA, February (1983)

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UNIVERSITY OF MIAMI
Curriculum Vitae

1. Date: March 11, 1997

PERSONAL

2. Name: Christian D. Wunsch

3. Phone-home: [DELETED]

4. Phone-office: (305) 585-6990

5. Address-Home: [DELETED]

6. Current Rank: Assoc. Prof.

7. Primary Dept: Pathology

8. Secondary Dept: None

9. Citizenship: U.S.A.

HIGHER EDUCATION

10.

Institution	Major	Degree and Date
Northwestern University	English	B.A. 1961
Northwestern University	Biochemistry(Med)	M.S. 1966
Northwestern University	Medicine	M.D. 1970
Northwestern University	Biochemistry(Med)	Ph.D. 1970

POST-DOCTORAL TRAINING

a. Intern in clinical pathology, Peter Bent Brigham Hospital Boston, Mass., 1970-1971

b. Resident in clinical pathology, Peter Bent Brigham Hospital Boston, Mass., 1971-1973

c. Research fellow in pathology, Harvard Medical School Boston, Mass., 1971-1973

BOARD CERTIFICATIONS AND LICENSURES

12. Certified in Clinical Pathology, American Board of Pathology, 1974

Florida License #21580, 1974-

PROFESSIONAL EXPERIENCES

14. Academic:
University of Miami School of Medicine — Assistant Professor 1973-1977
Associate Professor 1977-

15. Pathology:
Jackson Memorial Hospital
Director, Clinical Chemistry 1973-1975

Director, Rush Lab 1973-1974
Director, Blood Gas Laboratory 1975-1977
Director, Pathology Computer Services 1978-

Bascom Palmer/Anne Bates Leach Eye Hospital
Director, Clinical Laboratory Services 1976-

PUBLICATIONS

19. Articles in refereed journals:

Natural History of Lactic Acidosis after Grand-Mal Seizures,
A. E. Croxinger, J. C. Eustace, C. D. Wunsch and L. B. Gardner,
N. Engl. J. Med., 297:795 (1977)

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19. Other works, publications and abstracts:

Abstracts:

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A Method for Finding Similarities in the Amino Acid Sequence of Two Proteins. C. D. Wunsch and S. B. Needleman, Abstracts, 154th Meeting of the American Chemical Society 1967

Other reviews, publications:

Alanine Aminotransferase (ALT): Review of Methods, Bernard W. Steele, MD and Christian D. Wunsch, MD, PhD, ASCP Check Sample, 1991

The Task of Validating a Random Access Analyzer, the Ektachem 500, in a Clinical Setting, C. Wunsch and B. Steele, XIV Int. Conf. Clin. Chem. and 42nd Meeting, Am. Assn. Clin. Chem., 1990

Sample Bar Coding: Speed and Accuracy in a Hospital Clinical Chemistry Lab, C. Wunsch, MD, PhD, Identification Journal, April-May: 30 (1989)

Alanine Aminotransferase (ALT): Review of Methods, Bernard W. Steele, MD and Christian D. Wunsch, MD, PhD, ASCP Check Sample, 1987

The Detection of Similarities in Amino Acid Sequences, Doctoral Dissertation, Directed by C.W. Corcoran, PhD, 1970

Synthesis of Indole and Benzothiophene Analogues of Serotonin, Master's Thesis, Directed by J.A.D. Cooper, MD, PhD, 1966

Seminars, workshops, invited lectures:

Laboratory Computer Systems, Laboratory Medicine Seminar, South Miami Hospital, 1976

Clinical Laboratory Computer Systems Workshop, Co-director, 3rd Annual Meeting, Florida Section, Am. Assn. Clin. Chem., 1976

Ion Selective Electrodes, American Society for Medical Technology, 45th Annual Meeting, 1977

Computer Applications in Quality Control, Monthly Meeting, Florida Section, Am. Assn. Clin. Chem., 1978

An Update on Computer Systems for the Clinical Laboratory, Monthly Meeting, South Florida Society of Pathologists, 1981

Laboratory Computer Systems, Monthly Meeting, Florida Section, Am. Assn. Clin. Chem., 1981

Data Communications, Meeting of the South Florida Hospital Telecommunications Association, 1981

Myths and Misconceptions about Chemistry and Computers, 12th Annual Review and Recent Practical Advances in Pathology, University of Miami School of Medicine, Dept. of Pathology, 1987

Advances in Automation Workshop, American Association for Clinical Chemistry, 39th National Meeting, 1987

Barcode Technology, Trisectional Meeting of the American Association for Clinical Chemistry, 1987

Guest Lecturer, Clinical Laboratory Computer Systems, Department of Pathology, University of Texas Medical Branch, 1988

21. Funded Research in the last 5 years.

Co-Investigator, Sentinel Hospital Surveillance System, A Multisite AIDS epidemiological study by Centers for Disease Control, 5% effort 1988-1995

26. Other Professional Activities:

Society Memberships and Offices

American Chemical Society	1961-1991
Biological Section of the A.C.S.	1961-1991
American Assn. for Clinical Chemistry	1973-1991
Florida Section, A.A.C.C.	1973-1993
Chairman, Membership Committee	1973-1977
South Florida Society of Pathologists	1975-
Dade County Medical Association	1978-
Florida Medical Association	1978-
American Society of Clinical Pathologists	1978-
College of American Pathologists	1986-

Consultant to:

The Clinical Laboratory, Palm Beach, FL, on systems, 1976
Physicians Reference Lab., Miami, FL, on computers, 1981
American Dade, Miami, FL, on instrument interfacing, 1982

Sakot Labs, Miami, FL, on lab computers, [illegible]
Palm Beach Health Department, West Palm Beach, FL,
on computer programming, 1983, 1984
Professional Data Managers, Lake Worth, FL
on computer system generation, 1984
Eastman Kodak Co, Rochester, NY, on specimen identification, [illegible]
Baxter-Travenol, Paramax Div., Costa Mesa, CA, on automation, [illegible]
Bio-Rad Corp., on instrument interfacing, [illegible]

TEACHING

23. Specialization

U of M Medical School

Lecturer, Pathology Course		
1 - 3 Lectures		1974-1980
Lab Instructor, Mechanism of Disease		
2 weeks		1980-1982

Jackson Memorial Hospital

Medical Technology		1974-1978
Lecturer, 2 weeks		
Pathology Residency		
Lecturer, 1-4 weeks		1973-1978
Chemistry rotations		1973-1978
[illegible] program director		1977-1978
Lecturer, 1 week		1979-1989
Computer elective		1990-

SERVICE

30. University Committee and Administrative Responsibilities:

Departmental Responsibilities

Residency Committee, 1976-1977
Facilitator for billing operations, 1977-
KIP representative, 1978-1994
UMMG representative, 1994-
Ad Hoc Advisory Committee, 1979-1992
Director, Computer Services 1982-

Extra-departmental Responsibilities

Jackson Memorial Hospital:

Laboratory Computer Committee, Chairman	1974-1978
Medical Records Committee	1975, 1983-
Human Use Subcommittee on Radiation	1976-
Information System Steering Committee	1977-1990
Pharmacy Computer Selection Committee	1984-1986
Laboratory System (MIS) Committee	1984-1986
Medical Executive Committee, At-Large	1996-

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TABLE 7.—Estimated relative risks for current and former cigarette smokers, females aged 35 years or more, 4-year (1982–86) followup of American Cancer Society 50-State study (CPS-II)

Underlying cause of death	Current smokers[a]	Former smokers[a]
All causes	1.90 (1.82–1.98)[b]	1.32 (1.27–1.37)[b]
CHD, age ≥35 (410–414)[c]	1.78 (1.62–1.97)	1.31 (1.19–1.44)
CHD, age 35–64[d] (410–414)	3.00 (2.50–3.59)	1.43 (1.15–1.77)
CHD, age ≥65 (410–414)	1.60 (1.42–1.80)	1.29 (1.16–1.43)
Other Heart Disease[e] (390–398, 401–405, 415–417, 420–429)	1.69 (1.44–1.99)	1.16 (1.00–1.34)
Cerebrovascular Lesions, age ≥35 (430–438)	1.84 (1.56–2.16)	1.06 (0.88–1.27)
Cerebrovascular Lesions, age 35–64 (430–438)	4.80 (3.52–6.54)	1.41 (0.94–2.13)
Cerebrovascular Lesions, age ≥65 (430–438)	1.47 (1.19–1.81)	1.01 (0.83–1.24)
Other Circulatory Disease[f] (440–448)	3.00 (2.20–4.08)	1.34 (0.95–1.90)
COPD (490–492,496)	10.47 (7.78–14.09)	7.04 (5.33–9.30)
Other Respiratory Disease[g] (010–012,480–489,493)	2.18 (1.60–2.97)	1.38 (1.04–1.84)
Cancer, Lip, Oral Cavity, Pharynx (140–149)	5.59 (3.15–9.91)	2.88 (1.57–5.26)
Cancer, Esophagus (150)	10.25 (4.94–21.27)	3.16 (1.45–6.85)
Cancer, Pancreas (157)	2.33 (1.77–3.08)	1.78 (1.37–2.30)
Cancer, Larynx (161)	17.78 (3.45–91.74)	11.88 (2.46–57.34)
Cancer, Lung (162)	11.94 (9.99–14.26)	4.69 (3.86–5.70)
Cancer, Cervix Uteri (180)	2.14 (1.06–4.30)	1.94 (0.97–3.87)
Cancer, Kidney (189)	1.41 (0.86–2.30)	1.16 (0.72–1.87)
Cancer, Bladder, Other Urinary Organs (188)	2.58 (1.31–5.08)	1.85 (1.00–3.42)

NOTE: Preliminary estimates, based upon 2,418,909 woman-years of exposure among female subjects who never smoked regularly, or who smoked only cigarettes, present or past. Relative risks, estimated with respect to women who never smoked regularly, have been directly standardized to the age distribution of all woman-years of exposure.

[a] Refers to cigarette smoking status at enrollment (September 1982).

[b] Numbers in parentheses are 95-percent confidence intervals, computed on the assumption that the logarithm of relative risk was normally distributed.

[c] All disease codes refer to International Classification of Diseases, Ninth Revision.

[d] When an age range is given, it refers to the age at enrollment in 1982.

[e] Includes Hypertensive Heart Disease (401–404).

[f] Includes Aortic Aneurysm, Non-Syphilitic, and General Arteriosclerosis (440–441).

[g] Includes Influenza and Pneumonia (480–487).

SOURCE: Unpublished tabulations, American Cancer Society.

TABLE 6.—Estimated relative risks for current and former smokers of cigarettes, males aged 35 years or more, 4-year (1982–86) followup of American Cancer Society 50-State study (CPS-II)

Underlying cause of death	Current smokers[a]	Former smokers[a]
All causes	2.34 (2.26–2.43)[b]	1.58 (1.53–1.64)[b]
CHD, age ≥35 (410–414)[c]	1.94 (1.80–2.08)	1.41 (1.33–1.50)
CHD, age 35–64[d] (410–414)	2.81 (2.49–3.18)	1.75 (1.55–1.99)
CHD, age ≥65 (410–414)	1.62 (1.48–1.77)	1.29 (1.20–1.38)
Other Heart Disease[e] (390–398, 401–405, 415–417, 420–429)	1.85 (1.63–2.10)	1.32 (1.18–1.48)
Cerebrovascular Lesions, age ≥35 (430–438)	2.24 (1.88–2.67)	1.29 (1.10–1.51)
Cerebrovascular Lesions, age 35–64 (430–438)	3.67 (2.51–5.36)	1.38 (0.91–2.07)
Cerebrovascular Lesions, age ≥65 (430–438)	1.94 (1.58–2.38)	1.27 (1.07–1.50)
Other Circulatory Disease[f] (440–448)	4.06 (3.08–5.35)	2.33 (1.81–3.01)
COPD (490–492, 496)	9.65 (7.00–13.30)	8.75 (6.48–11.80)
Other Respiratory Disease[g] (010–012, 480–489, 493)	1.99 (1.52–2.61)	1.56 (1.25–1.95)
Cancer, Lip, Oral Cavity, Pharynx (140–149)	27.48 (9.96–75.83)	8.80 (3.15–24.59)
Cancer, Esophagus (150)	7.60 (3.81–15.17)	5.83 (3.02–11.25)
Cancer, Pancreas (157)	2.14 (1.62–2.82)	1.12 (0.86–1.45)
Cancer, Larynx (161)	10.48 (3.61–30.43)	5.24 (1.83–14.99)
Cancer, Lung (162)	22.36 (17.77–28.13)	9.36 (7.43–11.77)
Cancer, Kidney (189)	2.95 (1.92–4.54)	1.95 (1.31–2.90)
Cancer, Bladder, Other Urinary Organs (188)	2.86 (1.85–4.44)	1.90 (1.28–2.82)

NOTE: Preliminary estimates, based upon 1,491,791 man-years of exposure among male subjects who never smoked regularly, or who smoked only cigarettes, present or past. Relative risks, estimated with respect to men who never smoked regularly, have been directly standardized to the age distribution of all man-years of exposure.

[a]Refers to cigarette smoking status at enrollment (September 1982).

[b]Numbers in parentheses are 95-percent confidence intervals, computed on the assumption that the logarithm of relative risk was normally distributed.

[c]All disease codes refer to International Classification of Diseases, Ninth Revision.

[d]When an age range is given, it refers to the age at enrollment in 1982.

[e]Includes Hypertensive Heart Disease (401–404).

[f]Includes Aortic Aneurysm, Non-Syphilitic, and General Arteriosclerosis (440–441).

[g]Includes Influenza and Pneumonia (480–487).

SOURCE: Unpublished tabulations, American Cancer Society.

TABLE 7.—

Underlying caus of death
All causes
CHD, age ≥35 (
CHD, age 35–6
CHD, age ≥65
Other Heart D 401–405, 415–
Cerebrovascu (430–438)
Cerebrovascu (430–438)
Cerebrovascu (430–438)
Other Circula
COPD (490–
Other Respir (010–012, 48
Cancer, Lip, (140–149)
Cancer, Eso
Cancer, Pan
Cancer, Lar
Cancer, Lu
Cancer, Ce
Cancer, Ki
Cancer, Bl

NOTE: smoked who nev [a]Refers [b]Numbe relative [c]All dis [d]When [e]Includ [f]Includ [g]Includ SOUR

~~produced by~~ RJRTC

in

HUMPEREY

Smoking
Non-Smoking

Hypothetical
Relative Risk - Lung Cancer
Asbestos Exposure

100	5	20
	1	No asbestos

52312 8035

Hypothetical
Relative Risks - CHD

	Overweight	Not Overweight
Smoking	9	3
Non-Smoker	3	1